



RCA VICTOR

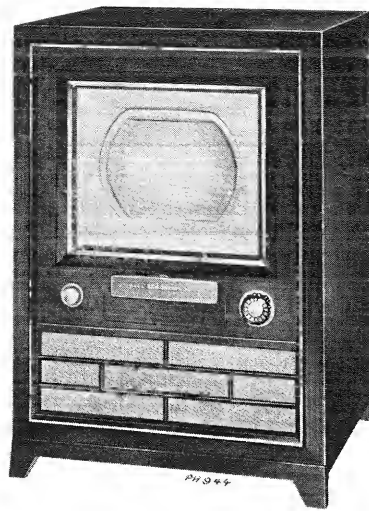
COLOR TELEVISION RECEIVER Model CT-100

Chassis No. CTC2

— Mfr. No. 274 —

SERVICE DATA

— 1954 No. T3 —



Model CT-100
Color Television Receiver

PREPARED BY RCA SERVICE CO., INC.

FOR

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION

CAMDEN, N.J., U.S.A.

GENERAL DESCRIPTION

Model CT-100 is a "15 inch" color television receiver, capable of reception of either black and white or color programs. The receiver employs the RCA shadow mask, three gun, directly viewed, 15 inch glass envelope type Tricolor Kinescope.

The receiver features: 12 channel VHF coverage plus any 4 UHF channels desired; intercarrier FM sound system; high level second detector operation for maximum linearity; stabilized horizontal AFC; electrostatic convergence and focus with dynamic modulation of the convergence and focus anodes; crystal controlled AFC color synchronization; low level color demodulation employing quadrature techniques; kinescope grid drive with D.C. restoration, and a color "killer" circuit to disable the color channel during black and white reception.

Additional features include: a removable top panel to facilitate servicing and adjustment, and the location of most of the functional controls at the receiver front. These controls are located under the tilt-down control cover or behind the removable panel directly below the control cover.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

PICTURE SIZE. Approx. 100 sq. ins. on a 15GP22 Kinescope

TELEVISION R-F FREQUENCY RANGE

Any of 70 UHF channels, 470 mc. to 890 mc.
Any of 12 VHF channels, 54 mc. to 88 mc., 174 mc. to 216 mc.
(Any desired combination of 16 UHF and/or VHF channels may be used.)

INTERMEDIATE FREQUENCIES

Picture I-F Carrier Frequency..... 45.75 mc.
Sound I-F Carrier Frequency..... 41.25 mc.
Color Sub-Carrier Frequency..... (Nominal) 42.17 mc.

POWER RATING..... 115 V. A.C., 60 Cy., 475 watts

AUDIO POWER OUTPUT RATING..... 3 watts max.

SWEEP DEFLECTION..... Magnetic

FOCUS..... Electrostatic

CONVERGENCE..... Electrostatic

ANTENNA INPUT IMPEDANCE

UHF—300 ohms balanced.

VHF—300 ohms balanced.

RCA TUBE COMPLEMENT

Tube Used	Function
(1) RCA 6BQ7A.....	R-F Amplifier (VHF Only)
(2) RCA 6AF4.....	R-F Oscillator
(3) RCA 6U8.....	I-F Amplifier
A K3E Crystal is used as a mixer	
(4) RCA 6DC6.....	1st Picture I-F Amplifier
(5) RCA 6DC6.....	2nd Picture I-F Amplifier
(6) RCA 6DC6.....	3rd Picture I-F Amplifier
(7) RCA 6AN8.....	4th Picture I-F Amplifier and Killer
(8) RCA 6CL6.....	5th Picture I-F Amplifier
A 1N60 Crystal is used as the picture 2nd Detector	
(9) RCA 6CL6.....	1st Video Amplifier

Tube Used

Function

(10) RCA 6AN8.....	2nd Video Amplifier and "Q" Phase Splitter
A 1N60 Crystal is used as the Sound Detector	
(11) RCA 6AU6.....	1st Sound I-F Amplifier
(12) RCA 6AU6.....	Driver
(13) RCA 6AL5.....	Ratio Detector
(14) RCA 6AV6.....	1st Audio Amplifier
(15) RCA 6AQ5.....	Audio Output
(16) RCA 12AT7.....	Vertical Sync. Separator and Sync. Output
(17) RCA 12BH7.....	Vertical Oscillator and Vertical Output
(18) RCA 12AU7.....	Vertical Convergence Amplifier
(19) RCA 6AN8.....	Horiz. Sync. Separator and AGC
(20) RCA 6SN7GT.....	Horiz. Sweep Oscillator and Control
(21) RCA 6CD6.....	Horiz. Sweep Output
(22) RCA 6AU4GT.....	Damper
(23) RCA 1X2B.....	Focus Rectifier
(24) RCA 3A3.....	High Voltage Rectifier
(25) RCA 6BD4.....	Shunt Regulator
(26) RCA 6AN8.....	Band Pass Amplifier and Keyer
(27) RCA 6BY6.....	"Q" Demodulator
(28) RCA 6AN8.....	Burst Amplifier and Phase Detector
(29) RCA 6AN8.....	3.58 MC Osc. and Reactance
(30) RCA 6AN8.....	Quadrature 3.58 MC Amplifier and Phase Detector
(31) RCA 6BY6.....	"I" Demodulator
(32) RCA 6AN8.....	"I" Amplifier and "I" Phase Splitter
(33) RCA 12BH7.....	Green Adder and Output
(34) RCA 12BH7.....	Blue Adder and Output
(35) RCA 12BH7.....	Red Adder and Output
(36) RCA 6BC7.....	Green, Blue and Red D.C. Restorers
(37) RCA 15GP22.....	Tricolor Kinescope
Two selenium rectifiers are used for Low Voltage rectification.	

SCANNING.....	Interlaced, 525 line
HORIZONTAL SCANNING FREQUENCY.....	15,750 cps (Nominal)
VERTICAL SCANNING FREQUENCY.....	60 cps (Nominal)
FRAME FREQUENCY (Picture Repetition Rate).....	30 cps

OPERATING CONTROLS (FRONT)

Channel Selector	{Dual Control Knobs
Fine Tuning		
Brightness	{Dual Control Knobs
Sound Volume and On-Off Switch		
Picture Horizontal Hold	{Dual Control (Knurled)
Picture Vertical Hold		
Contrast.....		Single Control Knob
Hue.....		Single Control Knob
Color.....		Single Control Knob
Tone.....		Single Control Knob

(LEFT SIDE)

Convergence.....	Upper Control Knob
Focus.....	Lower Control Knob

NON-OPERATING CONTROLS (REAR)

Purifying.....	Single Control
Field Neutralizing.....	Single Control
High Voltage.....	Screwdriver Control
Width.....	Screwdriver Adjustment
Horizontal Centering.....	Single Control
Vertical Centering.....	Single Control

NON-OPERATING CONTROLS (FRONT)

Vert. Conver. Amplitude.....	Screwdriver Adjustment
Vert. Conver. Shape.....	Screwdriver Adjustment
Blue Background.....	Screwdriver Adjustment
Green Background.....	Screwdriver Adjustment (Behind removable panel)
Height.....	Screwdriver Adjustment
Vert. Linearity.....	Screwdriver Adjustment
Video Blue Gain.....	Screwdriver Adjustment
Video Green Gain.....	Screwdriver Adjustment
Horiz. Conver. Amplitude.....	Screwdriver Adjustment
Horiz. Conver. Phase.....	Screwdriver Adjustment
Blue Screen.....	Screwdriver Adjustment
Green Screen.....	Screwdriver Adjustment
Red Screen.....	Screwdriver Adjustment
AGC.....	Screwdriver Adjustment
Sound Level.....	Screwdriver Adjustment

NON-OPERATING CONTROLS (TOP OF CHASSIS)

AFC Balance.....	Single Control
"I" Gain.....	Single Control
Horizontal Drive.....	Single Control
Horiz. Locking Range.....	Screwdriver Adjustment
Horiz. Convergence.....	Screwdriver Adjustment
Tuner IF Trap.....	Screwdriver Adjustment
FM Trap.....	Screwdriver (on Antenna lead)
Sound Reject.....	Screwdriver Adjustment

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER OUTSIDE THE CABINET OR WITH THE COVERS REMOVED, INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THE RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT. DO NOT OPERATE THE RECEIVER WITH THE HIGH VOLTAGE COMPARTMENT SHIELD REMOVED. BEFORE TURNING THE RECEIVER ON, INSURE THAT THE GROUND SPRINGS BETWEEN THE CHASSIS AND THE KINESCOPE SHIELD AND BETWEEN THE YOKE ASSEMBLY AND THE KINESCOPE SHIELD ARE MAKING CONTACT. BE SURE THE GROUND LEAD TO THE NECK SHIELD ASSEMBLY IS IN PLACE.

KINESCOPE HANDLING PRECAUTIONS

DO NOT REMOVE THE RECEIVER CHASSIS, INSTALL, REMOVE OR HANDLE THE KINESCOPE IN ANY MANNER UNLESS SHATTERPROOF GOGGLES ARE WORN. PEOPLE NOT SO EQUIPPED SHOULD BE KEPT AWAY WHILE HANDLING KINESCOPES. KEEP THE KINESCOPE AWAY FROM THE BODY WHILE HANDLING.

The kinescope bulb encloses a high vacuum and, due to its large surface area, is subjected to considerable air pressure. For this reason, the kinescope must be handled with more care than ordinary receiving tubes.

The large end of the kinescope bulb—particularly that part at the rim of the viewing surface—must not be struck, scratched or subjected to more than moderate pressure at any time. During service if the tube sticks or fails to slip smoothly into its socket, or deflecting yoke, investigate and remove the cause of the trouble. Do not force the tube. All RCA replacement kinescopes are shipped in special cartons and should be left in the cartons until ready for installation in the receiver.

INTRODUCTION

It is advisable that the reader be familiar with principles of black and white television explained in recent standard textbooks in order to properly understand the receiver circuits and their functions. Such a knowledge is assumed for the purpose of this publication. The discussions which follow will not describe in detail the operation of circuits which have been used in previous receivers and should be well known.

In general, the detailed discussions will apply only to the features in the compatible color television receiver, which are different from those found in conventional black and white television receivers.

For ease of understanding the operation of the new circuits in the receiver, a block diagram is shown in figure 1.

Throughout this publication references to new terms will be apparent. Typical terms which will be encountered in color television servicing are listed below with brief definitions.

ADDER—Tube after matrix section which combines "Y", "I" and "Q" signals (see below), before amplification and application to kinescope grids.

BURST—Portion of the composite color video signal used to establish color synchronization. Approximately 8 cycles at the 3.58 mc. sub-carrier frequency, transmitted following the horizontal sync pulse. Appears on the "back porch" of the horizontal blanking pedestal. The "burst" signal is to a color signal as the horizontal sync signal is to a black and white signal.

CHROMINANCE—Hue and Saturation (color) information. "I" and "Q" signals.

COLOR KILLER—Prevents operation of Chrominance channels ("I" and "Q" channels) when no burst (color sync) is being received. When color killer operates, kinescope will show a black and white picture.

CONVERGENCE—The coming together of the three electron beams at any given point at the plane of the aperture mask.

Note: Not to be confused with focus.

FOCUS—Focus occurs when the focal point (smallest beam diameter) of the electron beam or beams is adjusted to fall at the plane of the phosphor dots.

HUE—Redness, blueness, yellowness, etc. of colors.

LUMINANCE—Brightness information, similar to information used as video signal in black and white television.

MATRIX—Section of receiver where "Y", "I" and "Q" signals are combined.

NTSC—National Television System Committee.

PRIMARY COLORS—As used in color television green, red and blue.

Note: All colors do not appear the same to all observers. For this reason color can best be described as the reaction of the eye to a light stimulus causing a conscious sensation.

PURITY—Freedom of a given hue from dilution with other hues. As applied to color television, the control of the three electron beams so that each beam excites only its respective phosphor dots. Beam from red gun excites red dots, beam from blue gun excites blue dots, beam from green gun excites green dots.

QUADRATURE PHASE—90° out of phase. As—one signal in phase, another signal 90° out of phase with first signal.

SATURATION—Distinguishing highly saturated colors from pale colors of the same hue—such as red from pink, light blue from dark blue, etc.

SIGNAL "I"—In-phase Chrominance signal (Hue and Saturation).

SIGNAL "Q"—Quadrature phase Chrominance signal (Hue and Saturation).

SIGNAL "Y"—Signal containing brightness information.

SUB-CARRIER—In color television, a carrier signal, whose sidebands are inserted within the standard RF video passband, to provide for transmission of chrominance (color) information. Located 3.579545 mc. (3.58 mc. nominal) above the picture carrier frequency.

TUNER UNIT—The Tuner Unit is a KRK-12C UHF-VHF Tuner and is designed for 12-channel VHF coverage and 4-channel UHF coverage, although any combination of 16 VHF and/or UHF channels may be used. This coverage is made possible by tuned inserts which are placed within a drum assembly in the tuner. Four different types of inserts, marked "A", "B", "C" and "D", are used to cover channels 2 through 4, 5 and 6, 7 through 10, and 11 through 13, respectively.

Three different types of inserts, marked "G", "H" and "I", are used to cover channels 14 through 52, 53 through 68, and 69 through 83, respectively. Channel selection is performed by rotating the drum assembly to the position where the tuned insert for that channel is connected into the tuner circuits.

The stages in the KRK-12C include an R-F amplifier (V1) for VHF signals which uses a type 6BQ7A in a driven grounded-grid amplifier circuit. Tuned circuits at the input and output of the amplifier stage are mounted on each VHF insert. A triple-tuned pre-selector circuit, which precedes the mixer stage, is mounted on each UHF insert. The secondary of either the R-F amplifier plate circuit or the pre-selector circuit forms the tuned input circuit of the mixer stage.

A type K3E silicon crystal diode (CRI) is used in the mixer circuit for either VHF or UHF operation. The VHF oscillator voltage is injected into the mixer circuit capacitively on channels 2 through 6 and inductively on channels 7 through 13. The UHF oscillator voltage is injected into the mixer circuit through an adjustable inductance.

The oscillator stage (V2) uses a type 6AF4 in a modified Colpitts circuit and provides oscillator signals at a fundamental frequency for all VHF and UHF channels. A fine tuning control permits vernier adjustment of the local oscillator frequency.

The first I-F amplifier stage (V3) following the mixer stage uses a type 6U8 in a triode-pentode circuit with a low noise, grounded-grid input and a driven-pentode output. The I-F output of the tuner is in the 40 mc. range.

PICTURE I-F CHANNEL—The picture I-F amplifier is designed for a 45.75 mc. picture carrier, a 42.17 mc. color sub-carrier, and a 41.25 mc. sound carrier. The I-F amplifier consists of seven stages (including the two stages in the tuner unit). Three 6DC6's, the pentode section of a 6AN8, and one 6CL6 are used.

In order to reduce cross-modulation, the sound carrier is attenuated as soon as possible in the I-F amplifier by the Sound Level control 1R166 in the grid circuit of the first picture I-F amplifier V109 (6DC6). The output of V109 uses a bridged-T, m-derived, bandpass circuit with rejection traps for skirt selectivity (40.7 mc.) and adjacent sound (47.25 mc.).

The second, third, and fourth picture I-F amplifiers (V110, V111, and V112A) form a staggered, triple-tuned circuit with the second and fourth stages tuned, respectively, to the high and low frequency sides of the bandpass. The third stage is tuned to approximately the center of the band.

The fifth picture I-F amplifier (V113) uses a bridged π , M-derived, bandpass circuit and a mutually coupled absorption trap. The rejection traps are tuned for accompanying sound (41.25 mc.) and adjacent sound (47.25 mc.).

The picture second detector 1CR102 uses a 1N60 crystal diode.

DEFLECTION SYNCHRONIZATION—Sync signal is obtained from the plate circuit of the first video amplifier V114 and is DC coupled to the grid of the horizontal sync separator V117 (6AN8-triode section), and AC coupled to the grid of the vertical sync separator V118B (12AT7).

Horizontal and vertical sync are added in the grid circuit of V118A (12AT7) which serves the functions of sync amplifier and clipper. Variable clipping with signal strength is obtained by returning the grid resistor of the sync amplifier to the third picture I-F screen grid.

Improved vertical noise immunity is obtained by coupling negative noise pulses from the screen of the fifth picture I-F amplifier into the grid of the vertical sync separator. The output of the sync amplifier is used for both horizontal and vertical sync information. Vertical sync is coupled through a printed integrator circuit for proper shaping before it is applied to the vertical oscillator grid. Horizontal sync is capacitively coupled to the grid of the horizontal oscillator control tube.

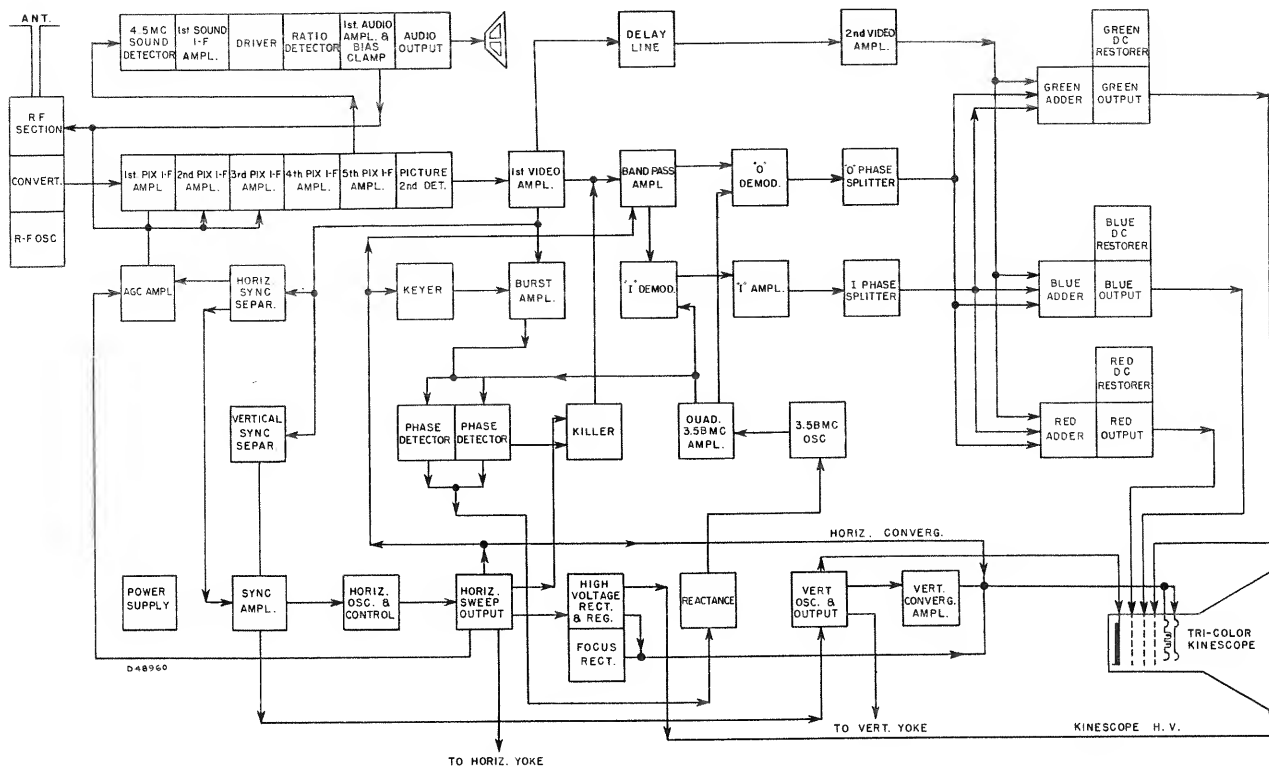


Figure 1—Receiver Block Diagram

AGC—The AGC amplifier V117B (6AN8-pentode section) derives its control voltage from the cathode of the horizontal sync separator. The control voltage acts as a bias on the AGC amplifier and is varied in amplitude with the AGC Control 1R139B. Plate voltage for the amplifier is obtained from the horizontal kickback pulse taken from the high voltage transformer 3T117.

Negative bias voltage is obtained by charging the plate capacitor 2C133 and is applied to the first, second, and third picture I-F and the R-F amplifier grids. The diodes of V104 serve as a clamp on the R-F bias which delays the rise of R-F bias for improved signal-to-noise ratio.

HORIZONTAL DEFLECTION AND HIGH VOLTAGE

—The horizontal oscillator and control V127 (6SN7-GT) is a "synchroguide" circuit, the output of which is used to drive the horizontal output V126 (6CD6). Fixed bias is supplied to the horizontal output and is used to protect the circuit against damage through failure of the horizontal drive signal.

The ultor voltage is supplied by the high-voltage rectifier V121 (3A3) which rectifies the kickback pulses. Regulation of the high voltage is effected by the shunt regulator V120 (6BD4). Bias on V120 and thus high voltage output is controlled by the high-voltage adjust control 3R256. In order to keep the convergence voltage a fixed part of the ultor voltage, the DC convergence control 3R254 is used as part of the high-voltage bleeder.

The focus voltage is supplied by the focus rectifier V124 (1X2B). Plate voltage for V124 is taken from a tap on the high-voltage transformer. The focus control 3R259, part of the rectifier bleeder network, controls an adjustable modulated DC voltage supplied to the focus electrodes from a tap on the convergence transformer.

Two separate windings on the high-voltage transformer provide kickback voltages for "killer" bias rectification, bandpass keying, burst keying, and horizontal dynamic convergence excitation. Taps on the high-voltage secondary, supply deflection pulses to the horizontal deflection coils. Electrical centering is provided by the horizontal centering control 3R261 which applies an adjustable DC voltage across the horizontal deflection coils.

VERTICAL DEFLECTION—The vertical oscillator and output V128 (12BH7) incorporates a blocking oscillator circuit, the output of which is amplified in the output stage, which in turn drives the vertical deflection coils through the vertical output transformer 17121. Electrical centering is provided through the vertical centering control 2R104 which applies an adjustable DC voltage across the vertical deflection coils.

SOUND I-F AND AUDIO CHANNEL—The sound information is taken off at the plate of the fifth picture I-F amplifier and is detected by 1CR101, a 1N60 crystal diode. The resultant 4.5 mc. sound I-F signal is coupled through the first sound I-F amplifier V101 (6AU6) and the driver V102 (6AU6) before it is applied to the ratio detector V103 (6AL5). The audio output of V103 is amplified by the first audio amplifier V104 (6AV6) and the audio output stage V105 (6AQ5) before it is applied to the speaker. The volume control 1R124B and the tone control 1R126 are connected into the grid circuit of the first audio amplifier stage.

VIDEO

The video section of the receiver incorporates three separate functions. The luminance, or brightness channel, the chrominance, or color channel and a function called matrixing which combines the two channels.

The luminance channel (luminance is designated by the symbol "Y") can be compared with the video section of a black and white television receiver since it deals only with information denoting the brightness values in the picture. It amplifies the brightness (black to white) information to a level satisfactory for application to the kinescope, the difference being that the information is applied through the matrix instead of directly to the kinescope.

The chrominance channel recovers the information contained in the color sub-carrier sidebands. Two independent signals are recovered from the color sub-carrier sideband signal by a process known as "synchronous detection in phase quadrature". These signals are called the "I", or in-phase signal, and the "Q" or quadrature phase (90° out of phase) signal.

In accordance with approved signal specifications the "I" channel passes information in a bandwidth limited to 1.5 mc. and the "Q" channel passes information in a bandwidth limited to .5 mc. ("I" and "Q" channel bandwidths are referenced to the color sub-carrier frequency). Band limiting, which is done to prevent cross-modulation, makes necessary a delay time between the "Y", "I" and "Q" signals so that they arrive simultaneously at the matrix for processing before application to the kinescope.

The matrix combines pre-determined proportions of "Y", "I" and "Q" information into simultaneous green, red and blue signals for application to the kinescope grids (Note: "Y", "I" and "Q" are *not* symbols for green, red and blue. Their proper designations are noted above).

LUMINANCE CHANNEL

The first video amplifier, a 6CL6, has both positive and negative video output polarities. Any sound present in the video signal is attenuated by a 4.5 mc. trap (2L108, 2C184) in the cathode output circuit. To prevent chrominance information from combining with luminance information before entering the matrix a 3.58 mc. color sub-carrier frequency trap (2L140, 2C188) is located in the plate circuit of the 6CL6 first video amplifier.

The sync and wideband video present at the plate of the 6CL6 provide the "Y" channel signal, burst (color sync), and horizontal and vertical sync information. "Y" information is fed through the delay line (2TD101) to a potentiometer in the grid circuit of the second video amplifier V115A (6AN8 pentode section). This potentiometer (2R210) is mechanically ganged with the potentiometer (2R204) in the grid circuit of V116A (6AN8 pentode section) the bandpass amplifier, and acts as the picture (contrast) control, maintaining a constant ratio between luminance and chrominance for all contrast settings.

Burst (color sync) is removed by a tuned circuit (2L141, 2C186) coupled to the color sub-carrier trap (2L140, 2C188). Sync information (horizontal and vertical) is removed at the junction of 2R207 and 2R206 and is fed to the horizontal and vertical sync separators V117B (6AN8, triode) and V118B ($\frac{1}{2}$ 12AT7).

The second video amplifier V115A (6AN8 pentode section) amplifies the "Y" (brightness) information to a level suitable for application to the matrix section.

CHROMINANCE CHANNEL

The signal removed from the cathode of V114, the first video amplifier, is fed to the grid of V116A (6AN8, pentode section), the bandpass amplifier, which removes the low frequency components of the signal with the bandpass filter (2T126) and retains the region of the color sub-carrier and its sidebands. The bandpass filter terminates in a control (2R317) which is used to vary the saturation of color (vivid red, pale red) by controlling the chroma voltage input to the "I" and "Q" demodulators.

The bandpass amplifier is inoperative during the burst interval at which time it is keyed "off" by a negative pulse derived from horizontal deflection (Terminal "E" on HV transformer 3T117) applied to the screen of V116A. This prevents the DC restorers from clamping on demodulated burst instead of tips of sync., thereby avoiding background unbalance in the kinescope.

Also, when no burst is present (black and white picture reception), the color-killer tube V112B (6AN8, triode section) conducts, and biases the grid of the bandpass amplifier to cut-off. This prevents signal information from entering the matrix circuits, via the "I" and "Q" demodulator circuits, and insures that only "Y" (brightness) information reaches the kinescope grids.

During burst the color-killer does not conduct, since it is held at cut-off by the negative DC voltage developed by the burst phase-detector (V130B).

Demodulation (detection) of the chroma signal ("I" and "Q") is accomplished by the synchronous detectors V132 (6BY6) and V133 (6BY6) operating in quadrature. With the demodulators operating in quadrature the "I" signal is detected in phase with the color sub-carrier and the "Q" signal is detected 90° out of phase from the color sub-carrier.

The detected "I" signal appears at the plate of V132 ("I" demodulator) and is fed through the band-limiting filter 2T123 to the "I" amplifier V134A (6AN8, pentode section) then to the "I" phase splitter V134B (6AN8, triode section)

which supplies positive and negative "I" signals required in the matrix section. The band-limiting filter also provides the time delay required to match "Q" signal time delay.

The detected "Q" signal appears at the plate of the "Q" demodulator V133 and through a band-limiting filter (2L122, 2C266, 2L123) is fed to the "Q" phase splitter V115B (6AN8, triode section) where positive and negative signals are present at the output for application to the matrix section of the receiver.

The proper amplitude ratio of "I" to "Q" signals is maintained by adjustment of the "I" gain control 2R361 in the cathode of the "I" signal amplifier V134A (6AN8, pentode section).

MATRIX AND OUTPUT

The matrix is the section of the receiver where the "Y", "I" and "Q" signals are mixed in proper proportions to provide outputs suitable for application to the kinescope control elements so that the brightness, hue and saturation of colors in the transmitted scene will be reproduced properly on the viewing screen of the kinescope.

The signal proportions are fed to the adder stages V135A, V136A, V137A, through fixed resistances, where the "Y", "I" and "Q" signals are combined in correct proportion.

Negative feedback from the cathodes of the output sections of the 12BH7 tubes V135B, V136B, V137B, is applied to the grids of the adder tubes for stabilization, to prevent undesirable color shift. The resulting low impedance input provides effective isolation of "Y", "I" and "Q".

Since the operation of the kinescope requires specific ratios of drive to produce a black and white picture (proper proportions of green, red and blue produce white) overall gain controls are provided for the green and blue channels (4R228 for the green channel, 5R330 for the blue channel). No gain control is provided for the red channel, because the red phosphor dots are least efficient and require maximum excitation to cause the phosphor to emit light. DC restoration is provided by the outputs of V138A, V138B, V138C, a triode-diode tube, type 6BC7.

The plate return circuits of the DC restorers are adjusted to maintain proper tracking of the three kinescope grid bias values throughout the range of the master brightness control (1R124A).

COLOR SYNCHRONIZATION

The color synchronizing channel consists of a "keyer" tube V116B (6AN8, triode section), a burst amplifier stage V129A (6AN8, pentode section), a phase detector V129B and V130B (6AN8, triode sections), a reactance control tube V131A (6AN8, pentode section), a quartz crystal oscillator operating at 3.58 mc. V131B (6AN8, triode section) and a quadrature amplifier V130A (6AN8, pentode section).

To provide color synchronization information in the N.T.S.C. type signal, a "burst" of approximately 8 cycles of the color sub-carrier frequency is transmitted following each horizontal sync pulse in the composite color video signal and appears on the "back porch" of the horizontal blanking pedestal. This "burst" is used as phase reference information, after separation from the composite color video signal, and serves to establish the proper phase relationship between the transmitted signal and the local 3.58 mc. sub-carrier. Since the sub-carrier is not transmitted it is necessary to generate a local sub-carrier of proper frequency and phase. The sub-carrier is generated by a (quartz) crystal controlled oscillator (V131B). A reactance tube (V131A) is used to maintain exact control of the crystal oscillator frequency.

The reactance tube is controlled by a voltage from the phase detector (V129B and V130B) which is proportional to the difference in phase between the transmitted burst and the local 3.58 mc. crystal oscillator output.

The burst amplifier stage amplifies the signal supplied from an inductance (2L141) which is coupled to the first video amplifier plate (V114). A trimmer capacitor (2C186) is used as the hue control (redness, blueness, greenness).

The keyer tube V129A, is driven by a pulse from the horizontal output transformer (Terminal "F" 3T117) and with its cathode connected to the cathode of V129A, the burst amplifier, provides automatic keying level adjustment.

The phase detector V129B and V130B, uses the triode sections of the 6AN8's as diodes, to compare the phase of the incoming burst signal with the phase of the 3.58 mc. c.w. signal from the crystal oscillator V131B. This signal is ob-

tained from the "I" output of the quadrature amplifier output transformer (Terminal "A" 2T125).

The crystal oscillator V131B operates as a cathode follower and drives the quadrature 3.58 mc. amplifier V130A, from a tap on the oscillator output transformer (Terminal "B" 2T128).

A plate circuit output (Terminal "F" 2T125) provides "Q" c.w. signal to the "Q" demodulator V133. The 3.58 mc. reference signal which is supplied to the phase detector also provides "I" c.w. to the "I" demodulator V132.

TRICOLOR KINESCOPE

The type 15GP22 tricolor kinescope, as used in this receiver, is a directly-viewed picture tube capable of producing either a full color or a black and white picture 11½ inches wide and 8¾ inches high with rounded sides.

Three electron guns are mounted at the base end of the tube with their axial centers parallel to the central axis of the tube and spaced 120° apart with respect to each other.

Enclosed within the glass tube envelope, at the viewing end of the tube, is an assembly consisting of an aperture mask, the phosphor dot viewing screen and a decorative mask.

The focus electrode potential is adjusted so that the beam from each of the three electron guns comes to focus at the phosphor dot viewing screen.

By means of a convergence electrode all three beams are made to converge at any given point at the plane of the aperture mask. (See figures 3 and 4.)

The tricolor phosphor dot plate (the viewing screen) has printed on its rear surface an orderly array of small, closely spaced phosphor dots, arranged in triangular groups of three which are called "trios". Each trio consists of a green light-emitting dot, a red light-emitting dot and a blue light-emitting dot.

The phosphor dot plate has approximately 195,000 dot trios or a total of 585,000 dots. Aluminization of the surface, after the dot trios have been printed, effectively increases the light output from the viewing screen and eliminates the need for an ion trap.

The aperture mask, a thin metal plate positioned a short distance behind the phosphor dot plate, contains round holes equal in number to and centered with respect to the dot trios (one hole for each dot trio).

A mumetal shield is placed around the glass bell end of the tube envelope to prevent stray magnetic fields from affecting tube operation.

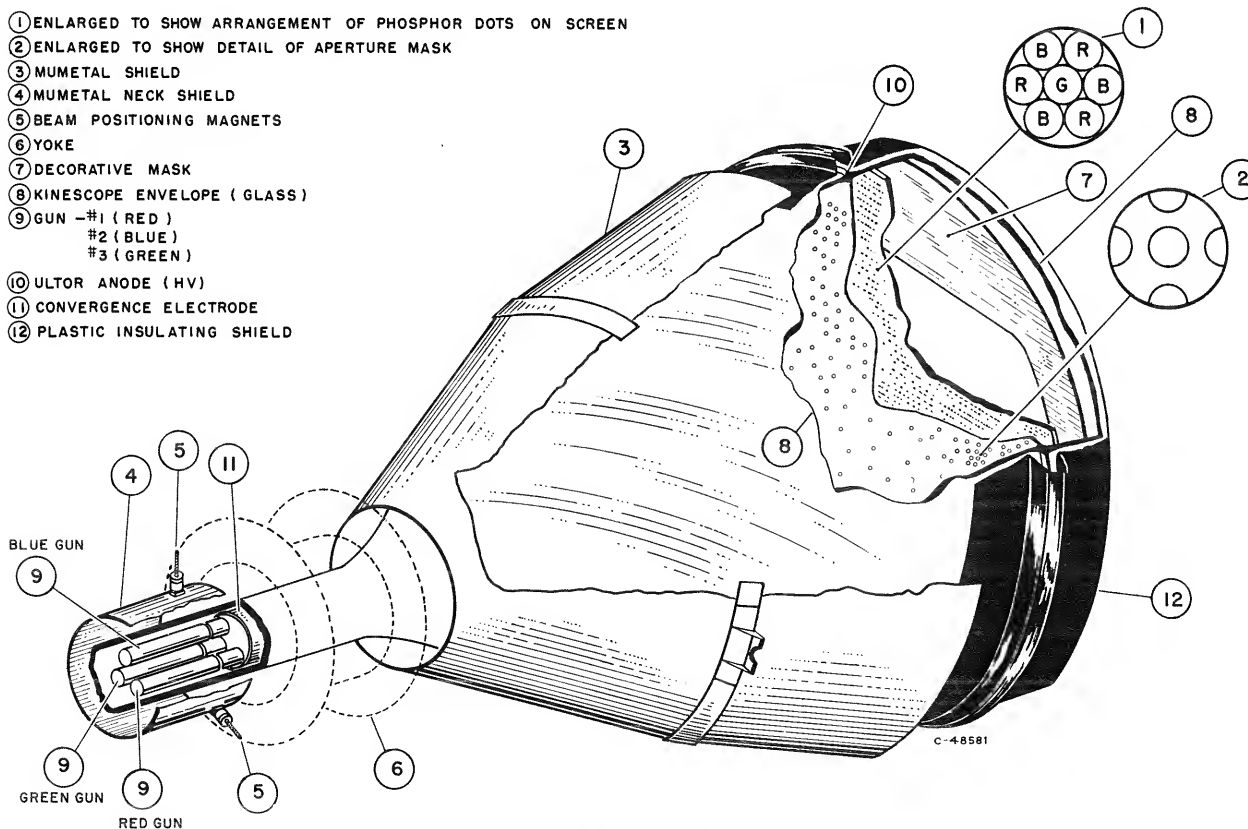
Another mumetal shield, positioned around the neck of the tube, prevents extraneous magnetic fields from interfering with the low velocity beams in the neck section. It also supports the beam-positioning magnets which are spaced 120° apart to correspond with the positions of the electron guns in the neck of the tube. The beam-positioning magnets are adjustable to provide accurate positioning of their associated beams in a direction perpendicular to the change in beam direction produced by the electrostatic convergence element in the kinescope.

The purifying coil is made adjustable to provide accurate alignment of the axes of the three beams so that their common axis coincides with the axis of the kinescope. As a result, when the beams are focused, converged and deflected, they approach each hole in the aperture mask at the proper angle to strike the centers of their respective color dots and produce color purity. (See figure 5.)

The field-neutralizing coil placed around the faceplate end of the kinescope produces a uniform magnetic field which can be varied to neutralize extraneous magnetic fields which may cause displacement of the beams from their color centers.

The high-voltage (ultor) connection is part of the peripheral faceplate tube-envelope seal.

- ① ENLARGED TO SHOW ARRANGEMENT OF PHOSPHOR DOTS ON SCREEN
- ② ENLARGED TO SHOW DETAIL OF APERTURE MASK
- ③ MUMETAL SHIELD
- ④ MUMETAL NECK SHIELD
- ⑤ BEAM POSITIONING MAGNETS
- ⑥ YOKE
- ⑦ DECORATIVE MASK
- ⑧ KINESCOPE ENVELOPE (GLASS)
- ⑨ GUN -#1 (RED)
#2 (BLUE)
#3 (GREEN)
- ⑩ ULTOR ANODE (HV)
- ⑪ CONVERGENCE ELECTRODE
- ⑫ PLASTIC INSULATING SHIELD



CUTAWAY DRAWING
15GP22 TRI-COLOR KINESCOPE

Figure 2—Tricolor Kinescope

DC (STATIC) CONVERGENCE

Converging the three beams at the center of the face of the tube is accomplished by adjusting the DC convergence control (3R254) for the best super-positioning of the beams. The three beam-positioning magnets are adjusted individually to correct inaccuracies which may result due to mechanical mis-alignment of the electron guns. (See figure 6.)

DYNAMIC CONVERGENCE

Because the aperture mask and the phosphor dot screen are flat, the beam must travel a greater distance from the center of deflection as it scans the edges of the screen than it does when scanning the center of the screen.

If the DC convergence voltage, which was required to achieve center convergence, remained unchanged, the three beams when scanning the edges of the screen, would become

mis-converged and the result would be color fringing at the edges of the picture. To correct this condition the DC potential on the convergence electrode is modulated in such a manner as to produce a larger convergence electrode voltage as the deflection angle increases (as the edges of the picture are scanned more DC convergence voltage is applied). The same condition also exists with respect to focus. (Refer to figure 6.)

The vertical dynamic convergence amplifier circuit (using a 12AU7-V119) combines, shapes and amplifies the parabola and saw-tooth waveforms, derived from the vertical deflection circuit. They are then combined with the sinewave horizontal waveform, which is derived from the two series tuned circuits, 1L138 and 3L139 connected to the horizontal kick-back (terminal "E" of 3T117). This combined waveform is used for modulation of the DC convergence and focus voltages applied to the kinescope.

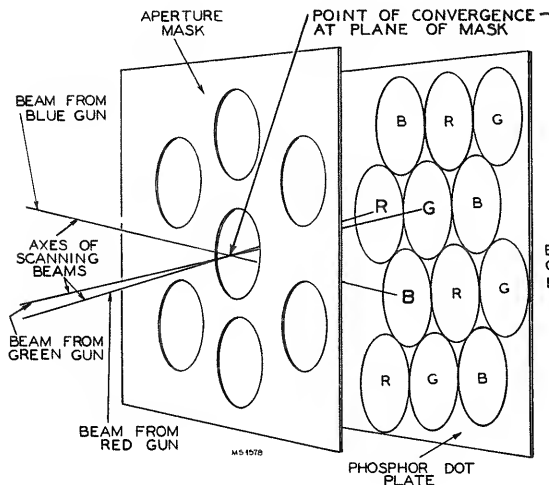


Figure 3—Optimum Convergence

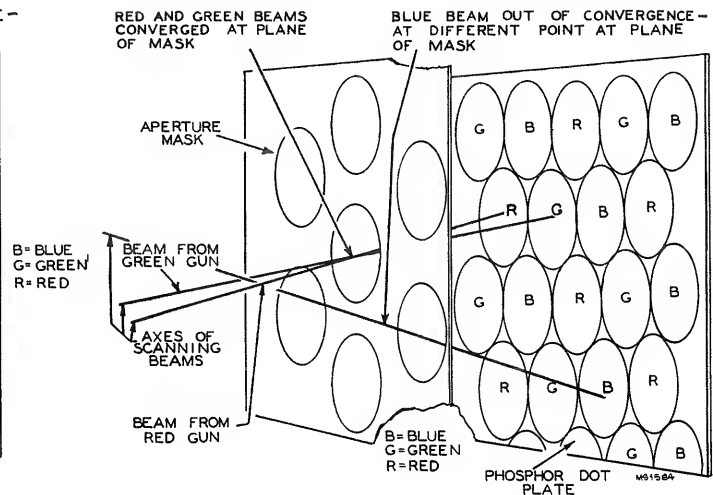
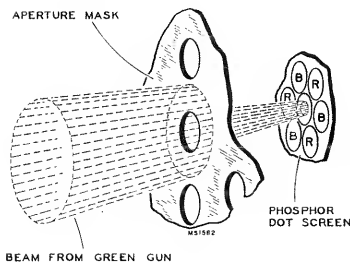


Figure 4—Beams out of Convergence

COLOR PURITY—ELECTRON BEAM FROM GUN PASSES THROUGH APERTURE HOLE(S) AT PROPER ANGLE TO HIT CORRECT PHOSPHOR DOT(S)



COLOR IMPURITY—ELECTRON BEAM FROM GUN PASSES THROUGH APERTURE HOLE(S) AT IMPROPER ANGLE AND HITS TWO OR THREE PHOSPHOR DOT(S) [OR POSSIBLY WRONG DOT(S) ENTIRELY]

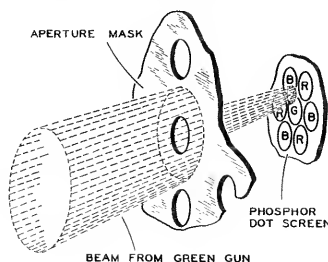


Figure 5—Color Purity

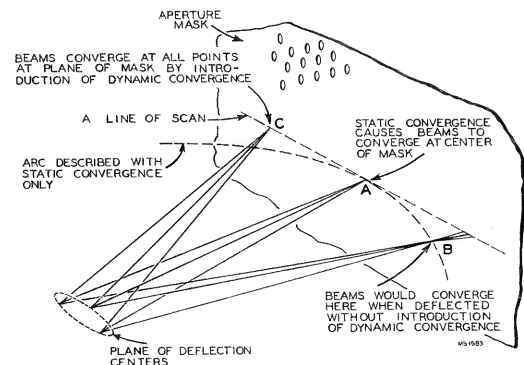


Figure 6—Effect of Dynamic Convergence

OPERATING INSTRUCTIONS

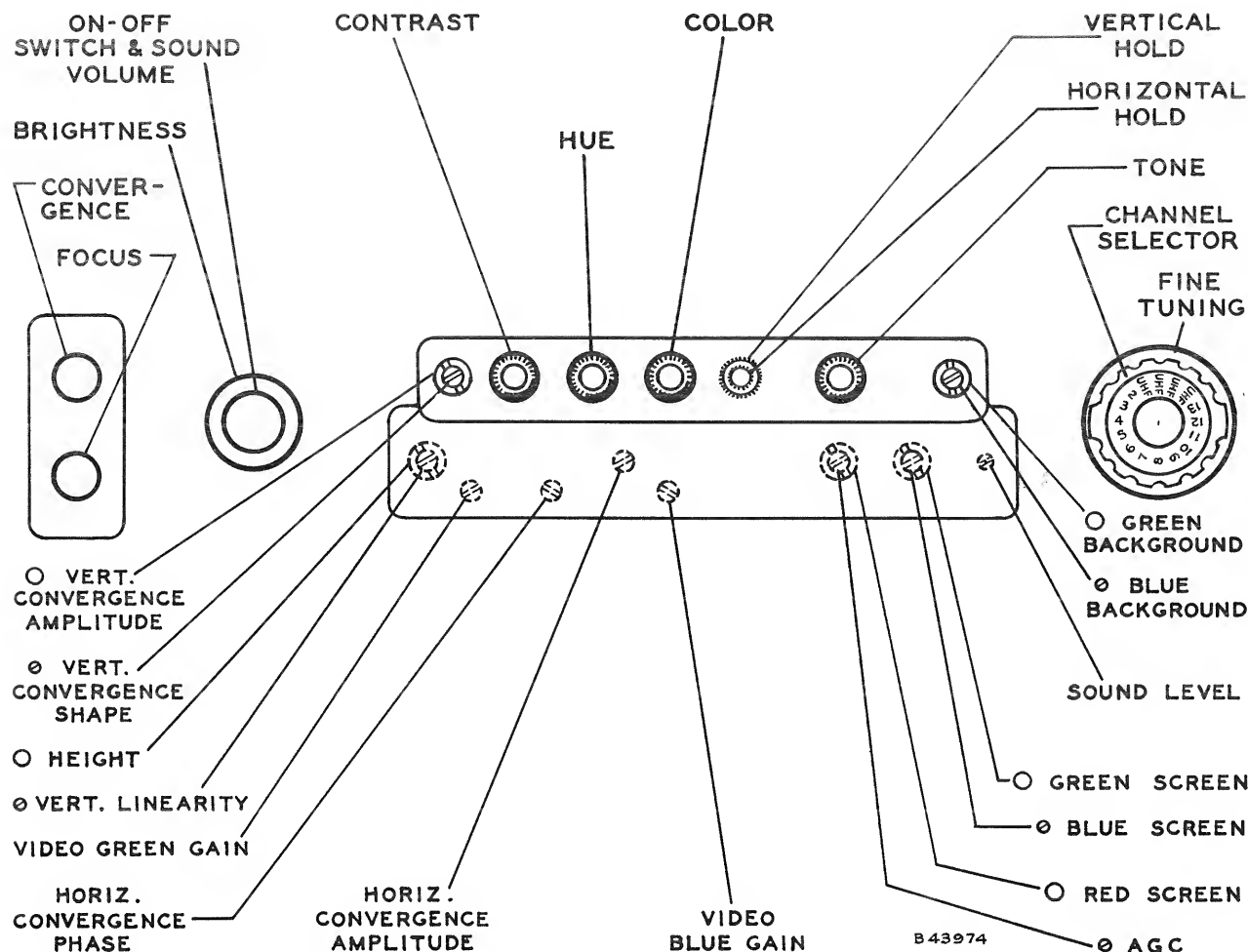


Figure 7—Operating Controls and Front Adjustments

OPERATING INSTRUCTIONS

The following adjustments are necessary when turning the receiver on for the first time.

BLACK and WHITE RECEPTION

1. Turn the receiver "ON" and advance the SOUND VOLUME control to approximately mid-position.
2. Set the CHANNEL SELECTOR to the desired channel.
3. Adjust the FINE TUNING control for best picture quality and the SOUND VOLUME for suitable volume.
4. Turn the BRIGHTNESS control fully counter-clockwise then clockwise until a light pattern appears on the screen.
5. Adjust the VERTICAL HOLD control until the pattern stops vertical movement.
6. Adjust the HORIZONTAL HOLD control until a picture is obtained and centered.
7. Turn the BRIGHTNESS control counter-clockwise until the raster just disappears.
8. Adjust the CONTRAST control for suitable picture contrast.
9. Should color fringes appear on large objects, adjust the CONVERGENCE control (top control on left side of cabinet) for minimum fringes at the center of the picture.
10. Adjust the FOCUS control (lower control on left side of cabinet) for clearest picture detail.
11. Adjust the TONE control for the desired tonal quality.

12. In switching from one channel to another, it may be necessary to repeat steps numbers 3 and 8.

13. When the receiver is turned on again after an idle period, it should not be necessary to repeat the adjustments if the position of the controls have not been changed. If any adjustment is necessary, steps 3, 8 and 10 are generally sufficient.

COLOR RECEPTION

1. Adjust the receiver for a black and white picture as outlined above, with the fine tuning control advanced to its most clockwise position where most detailed picture is obtained.
2. Set the CHANNEL SELECTOR to the desired channel broadcasting a color program.
3. Advance the COLOR control approximately two-thirds from its maximum counter-clockwise position.
4. Carefully advance the FINE TUNING control clockwise* until the picture just begins to disappear, then counter-clockwise*, *slowly* to the position where sound bars just disappear from the picture and color is in the picture.
5. Adjust the COLOR control for the desired saturation or strength of color.
6. Adjust the HUE control for hue quality of the picture (redness, blueness, etc.)—to achieve the most pleasing flesh tones or color of some familiar object.

*Direction of rotation reversed on UHF channels.

Each receiver is completely and properly adjusted at the factory and should not require further adjustment upon installation provided the assembly procedure is correctly followed.

The original relative positions of the kinescope and deflection components, established at the factory, are indicated by reference marks painted on the components as shown in figure 11B. The receiver is then disassembled

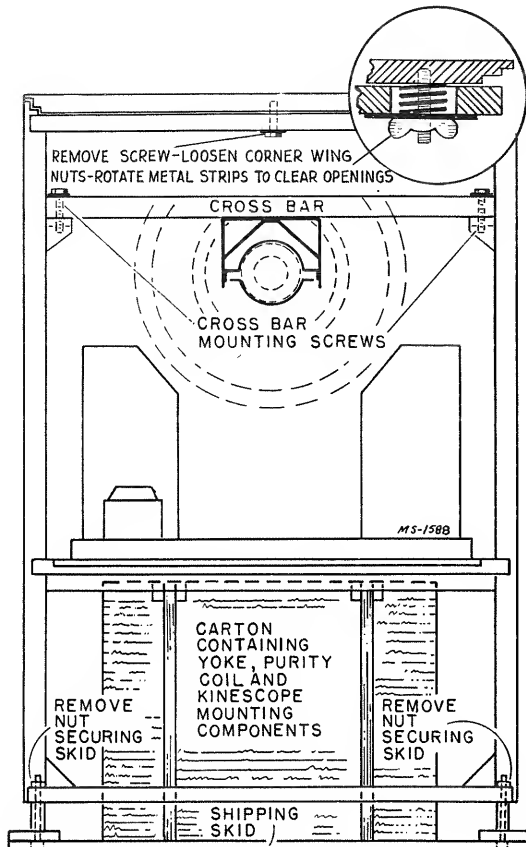


Figure 8—Cabinet Rear View

and the original components are shipped, in the same carton, with the receiver. The matched kinescope is shipped in a separate carton but as a part of the same receiver.

UNPACKING AND ASSEMBLY

Take the receiver out of its carton and remove all packing material.

A flat skid is attached to the bottom of the receiver cabinet for shipping purposes. To remove the skid, take off the two nuts on the bolts fastening the skid to the cabinet. (Refer to figure 8.)

With a man at each side of the cabinet, lift the cabinet directly upward and off the skid. The carton fastened to the skid, under the chassis shelf (see figure 8), contains the kinescope mounting rods, the mumetal shield and retaining ring, the yoke, the purity coil and neck shield assembly, the high-voltage anode lead and the high-voltage insulator.

KINESCOPE HANDLING PRECAUTION.—Do not open the kinescope shipping carton, install, remove, or handle the kinescope in any manner, unless shatter-proof goggles are worn. People not so equipped should be kept away while handling the kinescope. It is advisable before handling the kinescope, to check for the presence of any charge. This may be done by shorting the anode flange, with an insulated jumper, to the aquadag coatings at several points.

Installation of Kinescope.—Remove the cabinet back panel. Remove the cabinet top by removing the screw at the rear of the cabinet holding the top to the rear cross brace. (Refer to figure 8.) Reach under the cabinet top and loosen the wing nuts at each corner. Turn the metal tabs, under the wing nuts, to coincide with the slots in the cabinet braces. Slide the cabinet top approximately 1/4 inch to the rear and lift upward to remove.

Remove the cross-bar used to support the yoke assembly.

The kinescope should be installed with the cabinet resting on its face. A heavy pad should be used to protect the cabinet and front panel control knobs. The pad should be folded to a thickness of at least three inches under the top front edge

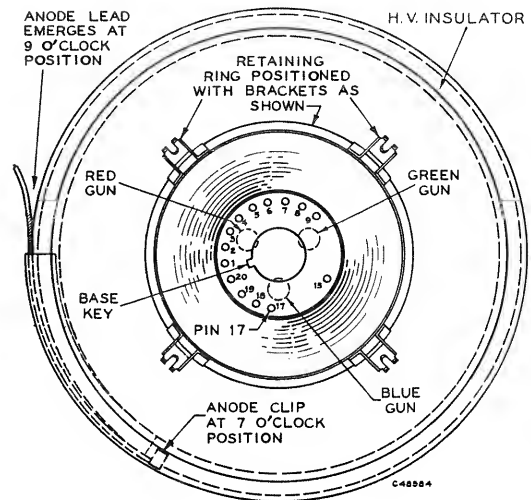


Figure 9—Kinescope Assembly

of the cabinet to provide sufficient clearance for the control knobs. Place pad as shown in figure 10.

Remove the kinescope from its carton, observing the precautions in handling as noted previously, by grasping the bell of the kinescope to remove. Place the kinescope face downward on a pad or some soft material. Do not grasp the kinescope by the neck to lift.

The kinescope is installed in the receiver with the mumetal shield, the high-voltage insulator and the mumetal shield retaining ring assembled on the kinescope. Make this assembly with the BLUE gun of the kinescope facing you. The position of the blue gun may be established from the numbers moulded on the kinescope base, or from the key on the base. Figure 9 will aid in determining the exact location of the blue gun.

Fasten the ultor anode lead clip at approximately the "seven o'clock" position. Place the high voltage insulator around the bell end of the kinescope over the ultor anode flange in such a position that the ultor anode lead protrudes from under the overlapping end at the "nine o'clock" position, as shown in figure 9.

Place the mumetal shield over the bell of the kinescope with the edge of the high-voltage insulator under the end of the shield. Install the retaining ring over the mumetal shield with the brackets on the ring positioned as in figure 9. The kinescope and assembly are now ready for installation in the cabinet.

Loosen the screws holding the flat grounding spring to the chassis.

Remove the plastic retaining block at the top of the cabinet. (See figure 10.) Grasp the kinescope at the bell end and carefully place in position in the plastic front mask, tilting the kinescope away from you to clear the cross brace at the top rear of the cabinet. The BLUE gun should be facing the cabinet top, with the ultor anode lead protruding from under the insulator at the "nine o'clock" position, as seen in figure 10. Make sure the grounding spring attached to the chassis

is making firm contact with the outside of the mumetal shield, then secure the spring.

Replace the plastic retaining block, pushing the block snugly against the top of the kinescope before tightening the screws.

Install the four retaining rods by hooking them over the metal loops provided at the cabinet front. Slide the rods into the slots in the retaining ring brackets and tighten the knurled nuts *just finger tight*.

The receiver should now be returned to an upright position for the installation of the yoke and purity coil assemblies.

From the front of the cabinet, check the alignment of the decorative mask, within the kinescope, with the edge of the cabinet mask. If the alignment is not proper, loosen the knurled nuts on the retaining rods slightly and rotate the kinescope to align the two masks. Tighten the nuts *just finger tight*.

DEFLECTION COMPONENT ASSEMBLY.—Mount the yoke assembly on the cross-bar previously removed from the cabinet, referring to figure 11 for detail of mounting. Install the cross-bar and yoke assembly as a unit. This is performed from the rear of the cabinet. Slip the yoke, with the insulated cover to the rear, over the neck of the kinescope and carefully slide it forward into position. Be sure the grounding springs are making contact with the kinescope shield. Fasten the cross-bar in place with the screws provided. (Refer to figure 11.)

The front edge of the yoke should be positioned approximately one-half inch from the bell of the kinescope. The kinescope neck should be centered in the opening through the yoke. The axes of the kinescope neck and the yoke opening should be parallel.

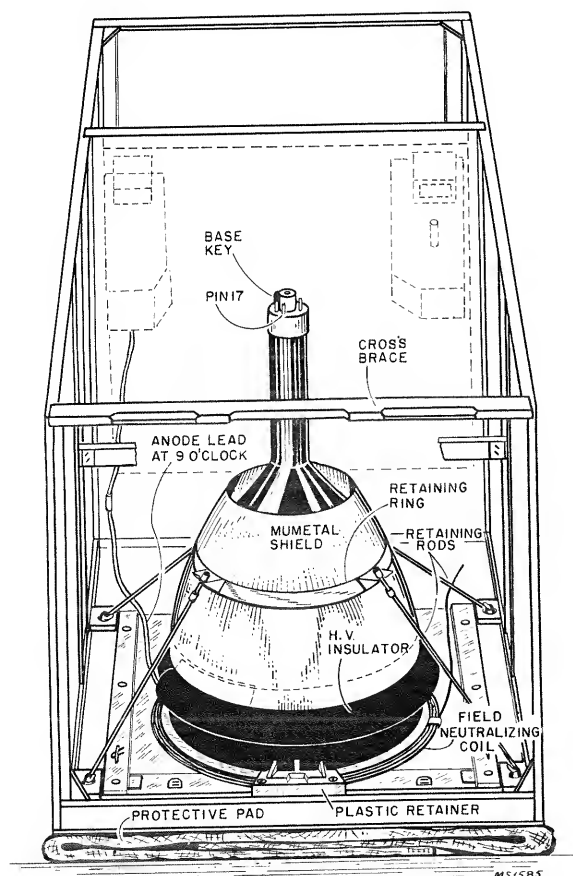


Figure 10—Kinescope Installation

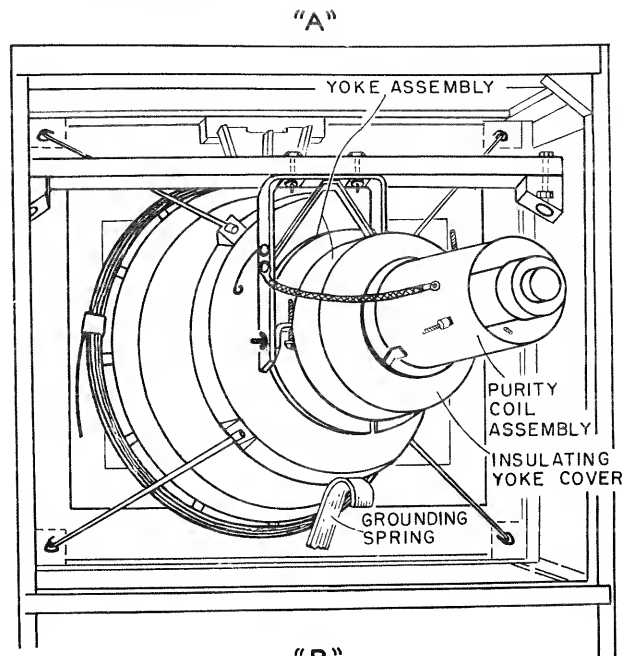


Figure 11—Yoke and Purity Coil Assemblies

Slip the purity coil and neck shield assembly onto the kinescope neck with the open end of the shield toward the cabinet rear. The access hole to the assembly mounting screw should be at the left, with the beam positioning magnet for the blue gun at the top, as shown in figures 11 and 12. Slide the assembly forward on the neck of the kinescope until the rear edge of the shield bracket is approximately $\frac{1}{4}$ inch beyond the front edge of the kinescope socket. Position the neck shield assembly to make the painted reference marks on the neck-shield bracket and on the kinescope neck coincide. (Refer to figure 11B.) Tighten the assembly on the kinescope neck. Plug the ground lead into the aperture at the left side of the neck shield.

Grasp the insulating flange of the purity coil at the front of the neck shield and rotate the flange to make the reference marks on the flange and on the top front edge of the neck shield coincide.

Place the socket on the kinescope base and connect the ultor anode lead. Insert the purity coil plug in its socket at the rear of the low-voltage compartment. (Refer to figure 13.)

Connect the antenna transmission line to the receiver.

Plug a jumper cord into the 117 volt a-c power source and turn the receiver power switch to the "on" position.

Proper operation of the receiver for both color and black and white transmissions should be obtained at this point.

A check for proper positioning of the purity coil and neck shield assembly may be performed, and slight readjustment made if indicated, by the following method.

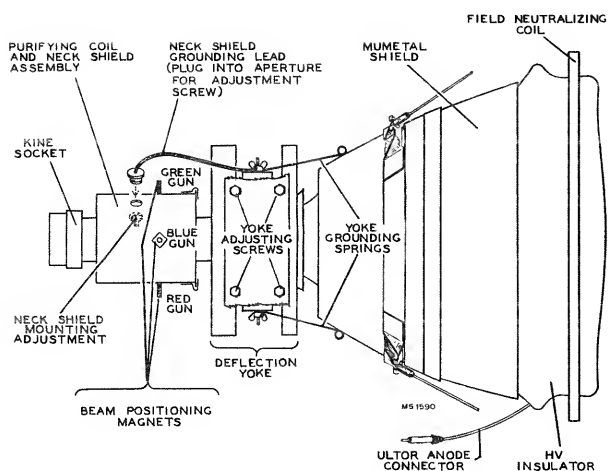


Figure 12—Purity Coil, Yoke and Beam Magnet Adjustments

Short the green and blue kinescope grids to ground at the terminals on the rear of the chassis (refer to figure 44) and observe the kinescope. A uniform red field should be obtained. Observe the green field by shorting the red and blue grids, and the blue field by shorting the red and green grids. Any slight readjustment which may be required should be made while observing the red field.

Replace the receiver cabinet back.

Performance of the "COMPLETE SET-UP PROCEDURE" should *only* be necessary when kinescope replacement is required or a definite determination has been made that such complete adjustment is required.

COMPLETE SET-UP PROCEDURE

Prior to making any picture adjustments, it is essential to have 19,500 volts applied to the ultor anode of the kinescope (see HIGH VOLTAGE ADJUSTMENT under ALIGNMENT PROCEDURE on page 22). A conventional black and white test pattern, if available, is useful for making initial adjustments. A dot pattern should be provided for convergence adjustments.

COLOR PURITY ADJUSTMENTS.—Turn the Contrast Control 2R204/2R210 to minimum (fully counter-clockwise). Refer to figures 7, 12, 13 and 44 for the location of adjustments. Turn the Brightness Control 1R124A to an average brightness position. Any color impurity will best be seen on a red display (blue and green screens, turned down). Therefore, set the Red Screen Control 1R139A to its maximum position. Set the Blue Screen Control 1R155B and the Green Screen Control 1R155A to their minimum positions (fully counter-clockwise). Remove the plug of the field neutralizing coil, 2P102M, or set the control, 2R107, to the center of its range. (See figure 13.)

To produce a small central area on the raster on which purity adjustments can be observed, the deflection yoke is moved approximately one inch toward the rear of the kinescope until a multi-color raster is seen. This is done by loosening the four screws at the top of the yoke cradle and sliding the yoke and cradle to the rear. (Refer to figure 12.) In this position the red area appears to cover, at the center of the raster, about one-third of the total raster area. With this arrangement, a minimum of purity coil correction will be necessary. The purifying coil and the purifying current control 2R106 are now adjusted alternately to give the best red rendition at the center area of the raster. The coil is adjusted by grasping the edge at the front of the neck shield and rotating it about the neck. The Purifying Control 2R106 is adjusted to give more or less coil current which causes more or less of a shift of the position of the red field. The final position of the control should be as near as possible to the extreme counter-clockwise position, so that minimum current will flow through the coil. A lower value of current will produce a weaker magnetic field, which has, therefore, less inter-action with other magnetic fields about the kinescope.

Advance the deflection yoke forward until an all red raster is produced. Be sure the grounding springs are making contact with the kinescope shield. Replace the plug 2P102M if previously

removed. Adjust the field neutralizing control 2R107, to give best raster edge purity. Since the adjustment of the deflection yoke may affect purity, a slight readjustment of the purifying coil and control may be necessary. Also, purifying coil adjustments will affect centering. If necessary, re-set the centering controls. In general, if good red field purity is obtained, green and blue fields will be satisfactory. To check the green field, turn the Red Screen Control 1R139A to minimum and advance the Green Screen Control 1R155A to maximum. Note the green field purity. Next, turn the Green Screen Control 1R155A to minimum and advance the Blue Screen Control 1R155B to maximum. Note the blue field purity. If either the green or blue or both fields are not satisfactory, a compromise must be reached for all three fields on the setting of the purity adjustments. Slight readjustments may be necessary to give best simultaneous red, green, and blue fields.

Set the brightness control to maximum. Turn up all three screen controls to give the best low level grey raster. If color shading occurs in one or more hues, either the screen controls for those hues must be turned down or those which do not give shading must be turned up.

INITIAL ADJUSTMENTS.—Adjust the receiver, as outlined in the "OPERATING INSTRUCTIONS", for a black and white picture.

If the Horizontal Oscillator and AGC system are operating properly, it should be possible to sync the picture at this point. However, if the AGC control is misadjusted, and the receiver is overloading, it may be impossible to sync the picture.

If the receiver is overloading it will be necessary to adjust the AGC control.

Remove the metal control cover box and the snap-in cabinet panel below the cover box. To do this, remove the four knobs under the control cover by grasping each firmly to pull out. Remove the two round-head screws holding the cover box in place. Carefully slide the cover box assembly outward.

Grasp the top of the removable cabinet panel and pull the panel away from its snap mounts. The front service adjustments will now be accessible.

Turn the AGC control counter-clockwise until the receiver operates normally and the picture can be synchronized. (Refer to figure 7 for adjustment location.)

It should be noted here that only the adjustment of the AGC control should be made at this time.

Adjustment of the other controls accessible under the removable panel should be made only after an understanding of their functions has been acquired. The proper adjustment of each control is explained in later sections of this publication.

With the conventional black and white test pattern or picture tuned in, the Convergence Control 3R253 (top control on the left side of the cabinet) should be adjusted for the best convergence of objects in the center of the picture. Best convergence is obtained when there is minimum color fringing around the objects.

The Focus Control 3R259 (bottom control on the left side of the cabinet) should be adjusted for best definition.

At this point it is necessary to adjust the horizontal oscillator and to make the conventional adjustments of height, vertical linearity, horizontal linearity, width, drive, and electrical centering if such adjustments are found necessary.

CHECK OF HORIZONTAL OSCILLATOR ALIGNMENT.—Turn the horizontal hold control to the extreme counter-clockwise position. The picture should remain in horizontal sync. Momentarily remove the signal by switching off channel then back. Normally the picture will be out of sync. Turn the control clockwise slowly. The number of diagonal black bars will be gradually reduced and when only 2 or 3 bars sloping downward to the left are obtained, the picture will pull into sync upon slight additional clockwise rotation of the control. Pull-in should occur before the control has been turned 70 degrees from the extreme counter-clockwise position. The picture should remain in sync for the balance of additional clockwise rotation of the control. At the extreme clockwise position, the picture should remain in sync and should not show a black bar in the picture.

When the receiver passes the above checks and the picture is normal and stable, the horizontal oscillator is properly aligned.

CENTERING ADJUSTMENT

Centering is accomplished by adjustment of the two electrical centering controls located on the rear of the chassis as shown in figure 13.

Adjust the vertical centering control 2R104A-B and the horizontal centering control 3R261 to center the picture within the mask of the kinescope. If the picture does not fully cover the masked area of the kinescope, adjust the positioning for equal distribution of blank area at top and bottom and at each side.

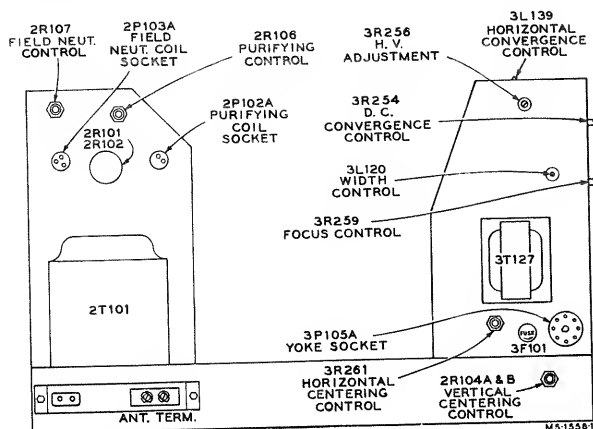


Figure 13—Rear Chassis Adjustments

WIDTH AND HORIZONTAL DRIVE ADJUSTMENTS

Pre-set the Horizontal Drive Control 2R266 on top of the receiver chassis (refer to figure 44), to the point where the vertical white fold-over line, which appears approximately three inches from the left edge of the screen, just disappears from the picture.

Adjust the Width Control 3L120 on the rear of the HV compartment, as shown in figure 13, to overscan the masking area by approximately one-quarter inch at each side.

Advance the Horizontal Drive Control 2R266 to as high a position as possible without white fold-over appearing in the picture.

If it is impossible to fill the mask by the above adjustments, it will be necessary to follow the procedure outlined under HV ADJUSTMENT on page 22 of the "ALIGNMENT PROCEDURE."

HEIGHT AND VERTICAL LINEARITY ADJUSTMENTS.—Adjust the height control 1R282A and the Vertical Linearity Control 1R282B (controls under cabinet front panel—see figure 7), until the picture or test pattern is symmetrical from top to bottom. Make the final adjustment to overscan the mask by one-quarter inch at both top and bottom. Recheck the horizontal and vertical centering for correct positioning of the picture with respect to the mask.

DC CONVERGENCE ADJUSTMENTS.—The dot signal generator should be connected to the receiver to provide a dot pattern on the kinescope for making convergence adjustments.

To do this, clip the "horizontal lead" from the dot generator to the insulation of the green lead from pin 2 of yoke plug, 3P105B, near its termination on the right side of the yoke.

Clip the "vertical lead" from the dot generator to the insulation of the lead to pin 19 of the kinescope socket near the 2700 ohm resistor. (Or wrap the lead around the top of V128, the vertical oscillator tube.)

For generators with internal vertical sync. omit this connection.

Connect the "ground lead" to the receiver chassis and the "output lead" to the Delay Line 2TD101, at the terminal board end near V115. **CAUTION.**—Do not short to chassis, this point is at +B potential.

Set the receiver to obtain a signal from some channel. This will provide sync. pulses to the dot generator.

NOTE:—Dot generators which provide an RF output should be connected to the antenna terminals of the receiver.

Adjust the DC Convergence Control (top knob on left side of cabinet) until the three dots appear separately and in a triangular arrangement in the center of the raster. (The dot triangle may be inverted by adjusting the DC Convergence Control from one extreme to the other.) If necessary, readjust the focus control. If each dot group does not form a small equilateral triangle, as shown in figure 14, it will be necessary to adjust the beam positioning magnets on the neck of the kinescope. Carefully note which of the three dots (red, green or blue) appears to be out of line. Then, adjust the beam positioning magnet, corresponding to that color, to correct the position of that dot. Adjustment is made by loosening the knurled nut which locks the magnet in position. Each magnet is slotted for screwdriver adjustment. Some knowledge of the effect of each magnet adjustment will be helpful. As shown in figure 14, the dots with "R", "G", and "B" inscribed denote the position of the red, green, and blue dots. The dashed lines indicate the direction of dot movement produced when the DC Convergence Control is adjusted. All three dots move simultaneously. The solid lines represent the direction of dot movement when the associated beam positioning magnet is adjusted. Each magnet has a slight effect on the two beams other than the one it is designed to control. It is essential, therefore, to use the minimum amount of magnet adjustment to correct each dot position. Minimum adjustment will also cause the least amount of de-focusing. This means that the magnet adjustment should be set to the point nearest the extreme counter-clockwise position where correct beam positioning is obtained.

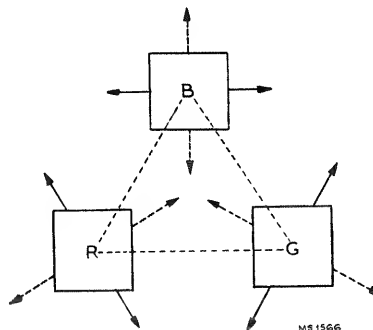


Figure 14—Dot Convergence Pattern

If it appears that only one dot is out of line and the associated magnet does not have the range of adjustment to correct the dot position, it is possible to alter the range of the adjustment by removing the magnet from the neck shield, turning it end-for-end, and re-inserting it in the neck shield. One end of each magnet is color coded in red. Each magnet is slotted at both ends so that adjustment can be made with either end projecting through the shield. If a single dot position cannot be corrected by reversing the magnet, return the magnet to its original position. Then correct the position of the opposite two dots with respect to the first dot by adjusting the magnets associated with those dots.

When the equilateral triangle is obtained, it will be possible to obtain satisfactory convergence of the three dots by adjusting the DC Convergence Control. Complete convergence is obtained at the center of the raster when the three dots are superimposed to give a single white dot with no color fringing around the edge of the white dot.

DYNAMIC-CONVERGENCE ADJUSTMENTS —

Although the same amplifier circuit applies both dynamic focus and dynamic convergence voltages to the kinescope, when the dynamic convergence adjustment is correct, the dynamic focus is satisfactory also. In adjusting dynamic convergence, it will be helpful to frequently vary the DC Convergence Control for optimum convergence on various parts of the screen.

With the dot signal generator connected to the Delay Line at the terminal board near VII5, adjust the Vertical Convergence Amplitude Control IR248A (see figure 7) so that dots along a vertical center line show the same dot displacement at the top, center, and bottom of the picture. Then, re-adjust the Focus Control. If the displacement is not the same, adjust the Vertical Convergence Shape Control IR248B (see figure 7) to obtain the most uniform displacement. It may be necessary to readjust the Vertical Convergence Amplitude Control. Readjust the DC Convergence Control so that the vertical line converges. Keep the dots in focus. Slight re-adjustment of the Vertical Amplitude and Shaping controls may be necessary to obtain the best top-to-bottom convergence.

The next step is to adjust the horizontal dynamic convergence. Advance the Horizontal Convergence Amplitude Control IR238 (see figure 7) so that dots along a horizontal center line show the same displacement at right, center, and left areas of the picture. If the displacement is not the same, adjust the Horizontal Phase Control IL138 to obtain the most uniform displacement. A slight re-adjustment of the amplitude control may be required. Re-adjust the DC Convergence Control so that the horizontal line converges. Keep the dots in focus. Slight re-adjustment of the horizontal amplitude and phase controls may be necessary to obtain the best side-to-side convergence.

The picture should now be converged over its entire area. If any area does not appear to be converged, and it can be converged by re-adjusting the DC Convergence Control, the dynamic convergence adjustments are not at optimum setting. Touch-up adjustments should be made after it is determined what correction is needed.

LOWLIGHT, MID-RANGE, AND HIGHLIGHT ADJUSTMENTS—At this point, color purity and convergence adjustments must be completed. Connect an antenna to the receiver and tune the receiver for reception of a black and white program. If this is not available, a black and white test pattern signal can be used. See figure 7 for adjustment locations.

Turn the Color Control and Contrast Control to the minimum positions (maximum counter-clockwise). Set the Brightness Control to near its maximum position (clockwise direction). Adjust the Red, Green, and Blue Screen Controls alternately for a light grey or low-brightness white picture.

Turn the Contrast Control clockwise to about the mid-position. Adjust the Green Video Gain and Blue Video Gain controls to produce a satisfactory white picture. Then, turn the Brightness Control down (counter-clockwise) to where a picture is just visible. Adjust the Green Background and Blue Background controls for a grey picture.

The procedure in the two preceding paragraphs should be repeated until satisfactory grey-to-white pictures are seen in all positions of the Brightness and Contrast Controls.

CHECK OF R-F OSCILLATOR ADJUSTMENTS

Tune in all available UHF and VHF stations to see if the receiver r-f oscillator is adjusted to the proper frequency on all channels. Set the fine tuning control to the center of its range. Adjust the oscillator core for each channel to obtain maximum audio output without distortion. The location of the adjustment is the same for all channels (see figure 15).

The insert in the operating position can be determined by a stamping on the insert drum. This stamping is visible through the channel indicator apertures as shown in figure 15.

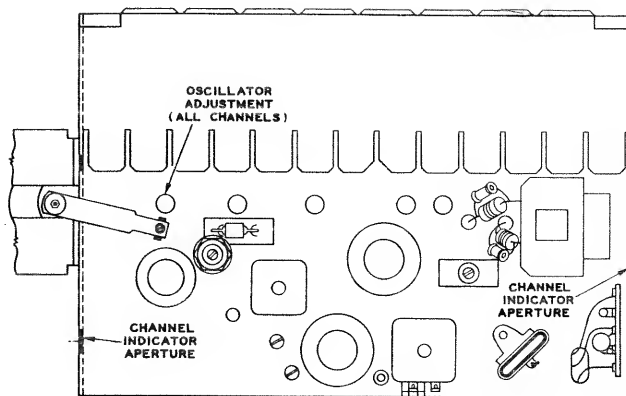


Figure 15—KRK12C Oscillator Adjustments

KINESCOPE AND SAFETY GLASS CLEANING.—The front safety glass may be removed to allow for cleaning of the kinescope faceplate and the safety glass.

To do this, remove the top panel of the receiver. There are eight flat springs holding the cabinet front metal trim to the plastic kinescope mask.

Reach over the top front of the receiver and press in on each spring at the open end. Slide the spring out of the slot provided. The front trim and safety glass should be held in position with the other hand to prevent its falling outward when removing the springs.

Remove the metal trim and the safety glass.

The kinescope faceplate and the safety glass should only be cleaned with a soft cloth and "Windex" or similar cleaning agent.

Replace the metal trim, safety glass, and cabinet top.

FM TRAP ADJUSTMENT.—In some instances interference may be encountered from a strong FM station signal. A trap is provided to eliminate this type of interference. To adjust the trap tune in the station on which the interference is observed and adjust the FM trap for minimum interference in the picture. The trap is fastened to the antenna transmission line inside the receiver.

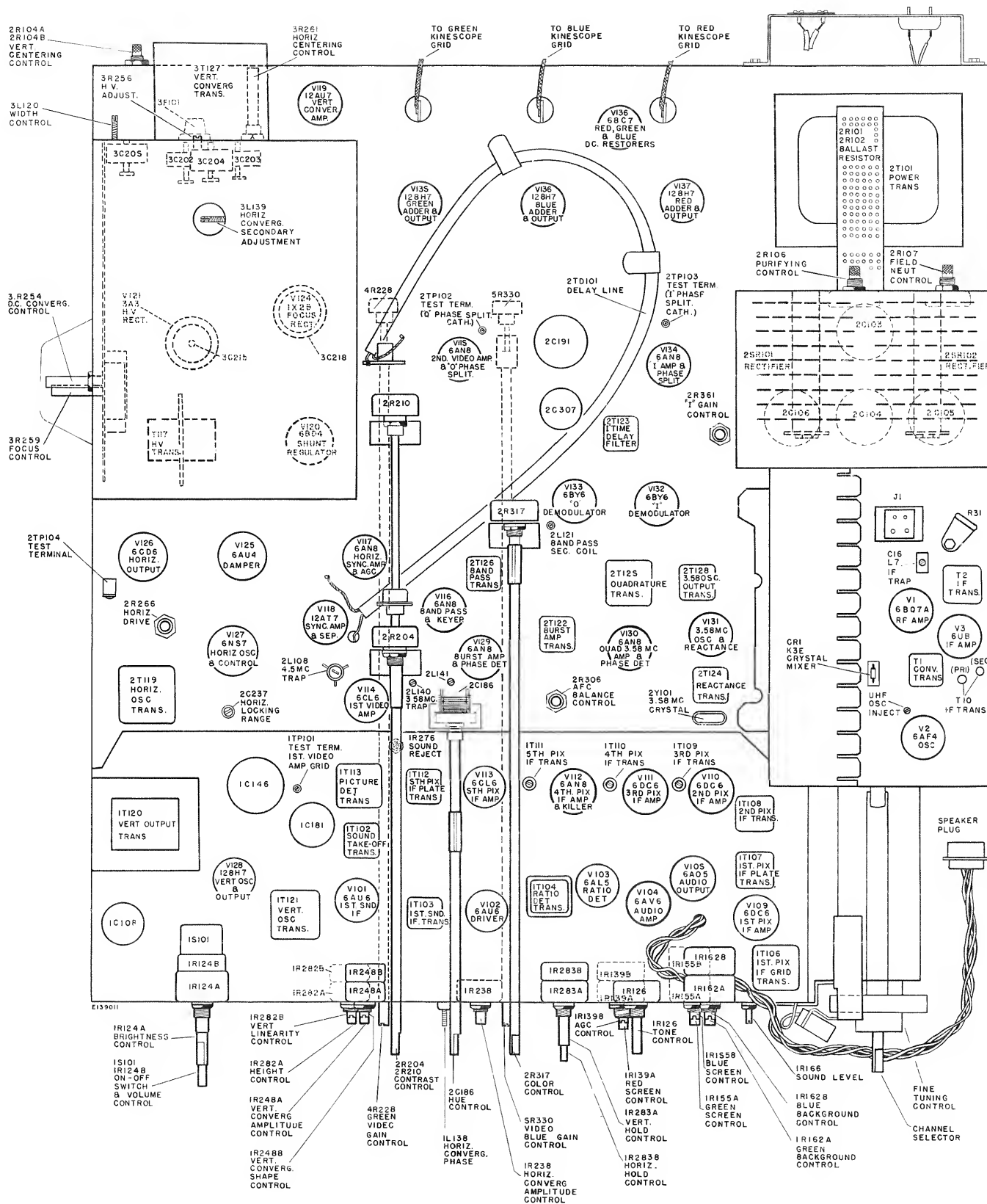
Replace the cabinet top panel. Make sure that the screws holding it are up tight, otherwise it may vibrate when the receiver is operated at high volume.

RECEIVER LOCATION.—The owner should be advised of the importance of placing the receiver in the proper location in the room.

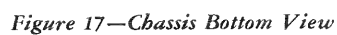
The location should be chosen—

- Away from bright windows and so that no bright light will fall directly on the screen. (Some illumination in the room is desirable, however.)
- To give easy access for operation and comfortable viewing.
- To permit convenient connection to the antenna.
- Convenient to an electrical outlet.
- To allow adequate ventilation.

ANTENNA INPUT.—Signals from separate UHF and VHF antennas may be fed to the tuner. To do this the 300 ohm crossover network mounted on the back of the cabinet is used to match the two 300 ohm lines, from the separate UHF and VHF antennas, to the signal 300 ohm tuner input. Connect the short jumper lead, from the crossover network terminal board, to the antenna terminals of the receiver. Connect the transmission lines, from the separate antennas, to their respective terminals on the crossover network terminal board, as shown in figure 30.



CT-100



TEST EQUIPMENT—To properly service these receivers, the following test equipment, or its equivalent, may be employed.

VHF Sweep Generator meeting the following requirements:

- (a) Frequency Ranges
 - 0 to 5 mc. Video Sweep
 - 35 to 90 mc., 1 mc. to 12 mc. sweep width
 - 170 to 225 mc., 12 mc. sweep width
- (b) Output adjustable with at least .1 volt maximum.
- (c) Output constant on all ranges.
- (d) "Flat" output on all attenuator positions.

(RCA WR-59C or WR-59B Modified for Video Sweep)

VHF Signal Generator to provide the following frequencies with crystal accuracy:

- (a) Intermediate frequencies
 - 4.5 mc., 40.7 mc., 41.25 mc., 41.65 mc., 42.17 mc., 43.5 mc., 45.75 mc., 47.25 mc.
- (b) Radio frequencies

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
2	55.25	59.75	101
3	61.25	65.75	107
4	67.25	71.75	113
5	77.25	81.75	123
6	83.25	87.75	129
7	175.25	179.75	221
8	181.25	185.75	227
9	187.25	191.75	233
10	193.25	197.75	239
11	199.25	203.75	245
12	205.25	209.75	251
13	211.25	215.75	257

- (c) Output of these ranges should be adjustable and at least .1 volt maximum.

(RCA WR-39C or WR-89A Crystal Calibrator)

VHF Heterodyne Frequency Meter with crystal calibrator if the signal generator is not crystal controlled.

UHF Sweep Generator with a frequency range of 470 mc. to 890 mc. RCA Types WR-40A, WR-41A or WR-86A or their equivalent.

UHF Signal Generator to provide the following frequencies with crystal accuracy if RCA Type WR-41A or WR-86A is used.

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
14	471.25	475.75	517
15	477.25	481.75	523
16	483.25	487.75	529
17	489.25	493.75	535
18	495.25	499.75	541
19	501.25	505.75	547
20	507.25	511.75	553
21	513.25	517.75	559
22	519.25	523.75	565
23	525.25	529.75	571
24	531.25	535.75	577
25	537.25	541.75	583
26	543.25	547.75	589
27	549.25	553.75	595
28	555.25	559.75	601
29	561.25	565.75	607
30	567.25	571.75	613
31	573.25	577.75	619
32	579.25	583.75	625
33	585.25	589.75	631
34	591.25	595.75	637
35	597.25	601.75	643
36	603.25	607.75	649
37	609.25	613.75	655
38	615.25	619.75	661
39	621.25	625.75	667
40	627.25	631.75	673
41	633.25	637.75	679
42	639.25	643.75	685

Channel Number	Picture Carrier Freq. Mc.	Sound Carrier Freq. Mc.	Receiver R-F Osc. Freq. Mc.
43	645.25	649.75	691
44	651.25	655.75	697
45	657.25	661.75	703
46	663.25	667.75	709
47	669.25	673.75	715
48	675.25	679.75	721
49	681.25	685.75	727
50	687.25	691.75	733
51	693.25	697.75	739
52	699.25	703.75	745
53	705.25	709.75	751
54	711.25	715.75	757
55	717.25	721.75	763
56	723.25	727.75	769
57	729.25	733.75	775
58	735.25	739.75	781
59	741.25	745.75	787
60	747.25	751.75	793
61	753.25	757.75	799
62	759.25	763.75	805
63	765.25	769.75	811
64	771.25	775.75	817
65	777.25	781.75	823
66	783.25	787.75	829
67	789.25	793.75	835
68	795.25	799.75	841
69	801.25	805.75	847
70	807.25	811.75	853
71	813.25	817.75	859
72	819.25	823.75	865
73	825.25	829.75	871
74	831.25	835.75	877
75	837.25	841.75	883
76	843.25	847.75	889
77	849.25	853.75	895
78	855.25	859.75	901
79	861.25	865.75	907
80	867.25	871.75	913
81	873.25	877.75	919
82	879.25	883.75	925
83	885.25	889.75	931

Absorption Type Video Marker Box—Marker Box to provide the following frequencies and adjusted to crystal accuracy on these frequencies: 0.5 mc.; 1.5 mc.; 2.5 mc.; 3.58 mc. and 4.5 mc. RCA WG-295 or equivalent.

(Used with RCA WR-59C Generator)

Cathode Ray Oscilloscope—An oscilloscope with an effective sensitivity of 1 millivolt per inch peak-to-peak is required. A suitable preamplifier may be employed with oscilloscopes of lesser sensitivity—RCA WO-56A or WO-88A, or equivalent.

Color Bar Generator—RCA WR-61A, or equivalent.

Dot Generator—RCA WR-36A or equivalent.

Electronic Voltmeter—A voltmeter with a 1.5 volt DC scale is required. RCA Senior or Master "VoltOhmyst" (with Diode Probe RCA WG-264 and HV Probe RCA WG-289 with WG-206) or its equivalent.

IF Load and Detector Block—Refer to figure 23 under Alignment Procedure.

Sound Attenuator Pad—Refer to figure 26 under Alignment Procedure.

Television Picture Carrier Signal Generator (with provision for Wide Band Modulation).—i.e. Crystal Diode Modulator and RCA WR-39C Crystal Calibrator.

Tuner Unit Input Head—Refer to figure 22 under Alignment Procedure. This item is absolutely necessary for proper receiver alignment.

Video Sweep Generator—Sweep Generator with a range of 0 to 5 mc. with markers—RCA WR-59C and Marker Box listed above, or equivalent.

VHF Attenuator Pad—Refer to figure 28 under Alignment Procedure.

Wide Band Oscilloscope—RCA WO-78A or equivalent.

The Horizontal Deflection Circuit should be disabled by removing fuse 3F101 when performing the alignment of the Sound IF, Picture RF and IF, and Video sections of the receiver. This is done to prevent horizontal pulse interference on the oscilloscope.

SOUND IF ALIGNMENT

Connect the VHF signal generator to terminal "C" of 1T102, the SOUND TAKE-OFF TRANSFORMER, and to ground. With a short jumper, ground the grid of the 5TH PICTURE IF AMPLIFIER, pin 2 of V113.

Connect the "VoltOhmyst" to the junction of 1R118 and 1R120, near pin 2 of V103 RATIO DETECTOR, and to ground.

Set the signal generator to 4.5 mc with maximum output and adjust 1T102 (top or bottom) and 1T103 (top and bottom), SOUND TAKE-OFF and SOUND IF TRANSFORMERS, for maximum indication on the "VoltOhmyst".

Tune the primary of the RATIO DETECTOR TRANSFORMER 1T104 (top), for maximum DC output on the "VoltOhmyst". Adjust the signal level from the signal generator for -12 volts on the "VoltOhmyst" when finally peaked. This is approximately the operating level of the ratio detector for average signals.

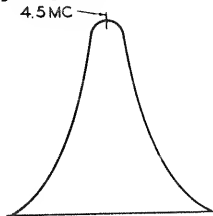


Figure 18
Sound IF
Response

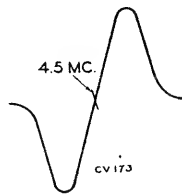


Figure 19
Ratio Det.
Response

Connect the "VoltOhmyst" to the junction of 1R119 and 1C120, ratio detector output, and to ground.

Tune 1T104 (bottom), ratio detector secondary, for zero DC on the "VoltOhmyst".

Repeat the adjustments of 1T104 (top) for maximum DC and 1T104 (bottom) for zero DC making final adjustment with the input from the signal generator adjusted to produce -12 volts on the "VoltOhmyst" at the junction of 1R118 and 1R120.

Connect a 1500 ohm resistor across terminals "B" and "C", the primary of 1T103 SOUND IF TRANSFORMER, and using the same signal output from the generator readjust 1T103 (bottom) for maximum indication on the "VoltOhmyst". Change the 1500 loading resistor to terminals "A" and "D" of 1T103 and adjust 1T103 (top) for maximum indication on the meter.

Remove the resistor, signal generator and "VoltOhmyst" from the circuit. Remove the jumper at pin 2 of V113.

PICTURE IF TRANSFORMER ALIGNMENT AND TRAP ADJUSTMENTS

Connect the oscilloscope, in series with a preamplifier if required, to test point 1TP101 at the output of the picture second detector.

Connect the VHF signal generator to the grid of the 5TH PICTURE IF AMPLIFIER, pin 2 of V113, and to ground. Modulate the signal generator to provide an indication on the oscilloscope.

With a short jumper, ground the grid of the 4TH PICTURE IF AMPLIFIER, pin 8 of V112A.

Set the VHF signal generator to 47.25 mc and tune 1T112 (top), 5TH PICTURE IF PLATE TRANSFORMER, for minimum indication on the oscilloscope. (Refer to figure 44.)

Set the signal generator to 41.25 mc and tune 1T113 (top), PICTURE SECOND DETECTOR TRANSFORMER, for minimum indication on the oscilloscope.

Disconnect the signal generator and the oscilloscope pre-amplifier, if used, and reconnect the oscilloscope to 1TP101 as before.

Connect the VHF sweep generator, using the shortest leads possible, to the grid of the 5th picture IF amplifier, pin 2 of V113, and to ground. Set the sweep generator for maximum output or six (6) volts peak on the oscilloscope, whichever is the lowest.

Couple the signal generator loosely to the grid of the 5TH PICTURE IF AMPLIFIER in order to obtain markers.

Adjust 1T112 (bottom), 5TH PICTURE IF PLATE TRANSFORMER, (see figure 45), and 1T113 (bottom), PICTURE SECOND DETECTOR TRANSFORMER, for maximum gain and curve shape as shown in figure 20. While observing the curve shape on the oscilloscope, adjust 1R276, the SOUND REJECTION CONTROL at 1T113, for maximum rejection at 41.25 mc.

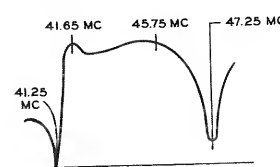


Figure 20
5th Picture
IF Response

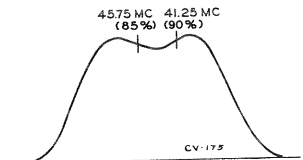


Figure 21
T1 and T10 Tuner
IF Response

Remove the sweep and signal generators, oscilloscope and the jumper shorting pin 8 of V112A.

The balance of the picture IF adjustments will be performed with the sweep or signal generators connected to the front terminal of CRL, the K3E crystal mixer, of the KRK12C tuner. Extremely short leads must be employed in connecting to the crystal mixer and in grounding to the tuner case in order to obtain reliable response curves. An "Input Head" has been designed for this purpose and should be employed to achieve proper alignment of the receiver. This "Input Head" is shown in figure 22.

Connect the signal generator to the front terminal of the crystal mixer, CRL, employing the "Input Head" mentioned above.

Obtain three 7.5 volt batteries capable of withstanding appreciable current drain and connect two of the batteries in series making a 15 volt bias supply. Connect the ends of a 1000 ohm potentiometer across the battery combination. Connect a second potentiometer across the ends of the single 7.5 volt battery. Connect the positive terminal of the 7.5 volt bias box to the chassis and the potentiometer arm to the junction of 1R178 and 1C169 (at 1T109—3rd picture IF transformer). Adjust bias box for -6 volts DC at the junction point.

With a short jumper ground the junction of 2R133 and 2R134 in the plate circuit of V117A, the AGC amplifier.

Connect the "VoltOhmyst" between test point 1TP101 and terminal "E" of 1T113, the PICTURE 2ND DETECTOR TRANSFORMER.

Set the signal generator to each of the following frequencies and peak the specified adjustment for maximum indication on the "VoltOhmyst", reduce the generator output if necessary to maintain a -6 volt level on the "VoltOhmyst", with -6 volts of IF bias at the junction of 1R178 and 1C169.

44.9 mc.....	1T109 (top)
42.1 mc.....	1T110 (top)
41.3 mc.....	1T111 (top)

Remove the signal generator, "VoltOhmyst" and the bias box used to provide bias for alignment.

Connect the VHF sweep generator to the front terminal of the crystal mixer CRL, employing the "Input Head" as before. Clip a 56 ohm composition resistor between terminals "C" and "D" of T2, the IF TRANSFORMER on the KRK12C tuner.

Connect the "Detector" lead from the "IF Test Block" shown in figure 23, to test point TP2 on top of the tuner. Connect the oscilloscope to the "Oscilloscope" terminals on the "IF Test Block".

Couple the VHF signal generator loosely to the grid of the 1st picture IF Amplifier in order to obtain markers.

Adjust T10, primary and secondary, for maximum gain and curve shape as shown in figure 21. Use .3 volts peak to peak on the oscilloscope during adjustment.

Remove the 56 ohm load resistor, "IF Test Block", oscilloscope and the sweep and signal generators.

ALIGNMENT PROCEDURE

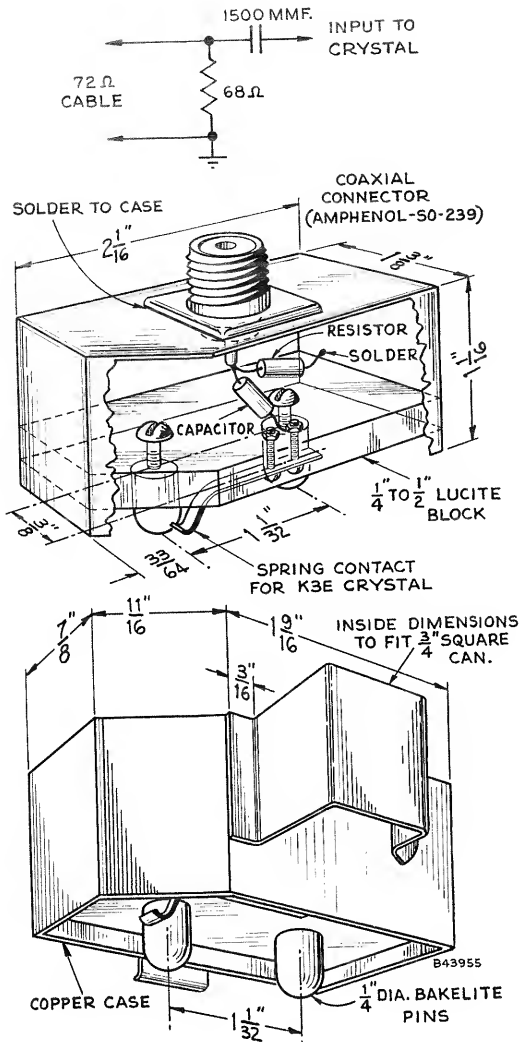


Figure 22—KRK12C Input Head

Connect the load leads from the "IF Test Block" to pin 5 of V110 and pin 5 of V111, plates of the second and third picture IF amplifiers.

Ground the IF AGC buss at the junction of 1R178 and 1C169, at 1T109, 3rd picture IF transformer.

Connect the "Detector" lead from the "IF Test Block" to the plate of the first picture IF amplifier, pin 5 of V109 and the oscilloscope, through the preamplifier if required, to the "Oscilloscope" terminals of the "IF Test Block". (Refer to figure 23.)

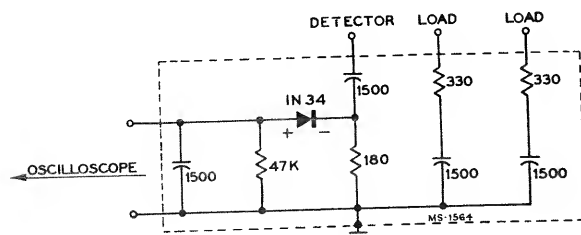


Figure 23—IF Test Block

Connect the VHF signal generator, using the "Input Head", to the front terminal of the crystal mixer CR1. Set the signal generator to 41.25 mc and modulate the generator for indication on the oscilloscope.

Adjust 1T106 (top), 1ST PICTURE IF GRID TRANSFORMER, for minimum response on the oscilloscope at 41.25 mc.

Remove the VHF signal generator and connect the VHF sweep generator, using the "Input Head", to CR1.

Remove the oscilloscope and the preamplifier from the "IF Test Block" and reconnect the oscilloscope, without the preamplifier, to the "Oscilloscope" terminals of the "IF Test Block". Couple the VHF signal generator loosely to 1st picture IF amplifier grid in order to obtain markers.

Adjust 1T106 (bottom), 1ST PICTURE IF GRID TRANSFORMER, and T2, IF TRANSFORMER on the KRK12C tuner, for maximum gain and curve shape as shown in figure 24. Use .3 volts peak-to-peak on the oscilloscope. While observing the response on the oscilloscope, set 1R166, the SOUND LEVEL CONTROL located at terminal "D" of 1T106, for maximum rejection at 41.25 mc. See figure 24.

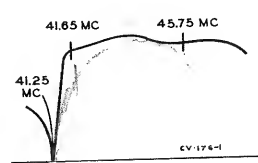


Figure 24—T2 and 1T106 Response from CR1

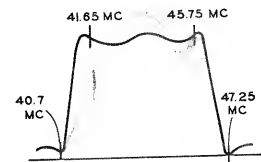


Figure 25—1T107 and 1T108 Response from CR1

Disconnect the "Detector" lead of the "IF Test Block" from pin 5 of V109 and reconnect it to pin 5 of V110, 2ND PICTURE IF AMPLIFIER.

Connect the "Load" leads from the "IF Test Block" to pin 5 of V111 and pin 6 of V112A, plates of the 3rd and 4th picture IF amplifiers. Leave the oscilloscope connected to the "Oscilloscope" terminals of the "IF Test Block". Connect the signal generator to CR1. Short the junction of 1R178 and 1C169 to ground.

Adjust 1T107 (top), 1ST PICTURE IF PLATE TRANSFORMER, for minimum response at 40.7 mc. Adjust 1T108 (top), 2ND PICTURE IF GRID TRANSFORMER, for minimum response at 47.25 mc.

Remove the jumper from the junction of 1R178 and 1C169 and connect the negative terminal of the 15 volt bias box to this point. Adjust the bias potentiometer to read -6 volts DC at the junction of 1R178 and 1C169. With the jumper, short the junction of 2R133 and 2R134, in the plate circuit of V117A AGC Amplifier, to ground.

Remove the signal generator from CR1, and connect the sweep generator to CR1 using the "Input Head". Remove the oscilloscope preamplifier and reconnect the oscilloscope directly to the "Oscilloscope" terminals of the "IF Test Block".

Couple the signal generator loosely to the 1st picture IF amplifier grid in order to obtain markers.

Adjust 1T107 (bottom), 1ST PICTURE IF PLATE TRANSFORMER, and 1T108 (bottom), 2ND PICTURE IF GRID TRANSFORMER, for maximum gain and curve shape as shown in figure 25.

Disconnect the VHF signal generator and the VHF sweep generator. Insert the preamplifier, if needed with the oscilloscope used, in series with the oscilloscope connected to the "IF Test Block".

Connect the sound attenuator pad, shown in figure 26, in series with the VHF signal generator to the front terminal of CR1, using the "Input Head". Use internal modulation of the VHF signal generator and set the generator to 43.0 mc. Note the output level on the oscilloscope at 43.0 mc. Remove the attenuator pad and reconnect the signal generator to CR1. Set the signal generator to 41.25 mc and readjust 1T106 (top) for minimum response.

Turn 1R166, SOUND LEVEL CONTROL, counter-clockwise from its maximum attenuation position just obtained, to achieve the same output indication on the oscilloscope as that obtained previously at 43.0 mc with the attenuator pad.

Remove the "IF Test Block" and the oscilloscope.

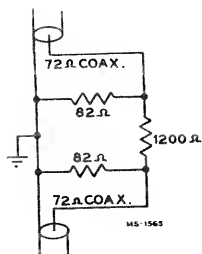


Figure 26—Sound Attenuator Pad

OVER-ALL IF ALIGNMENT

Change the IF bias at the junction of 1R178 and 1C169 to read -9 volts DC on the "VoltOhmyst".

Connect the oscilloscope to test point 1TP101, at picture second detector output, and calibrate the oscilloscope to read 6 volts peak to peak.

Connect the sweep generator, using the "Input Head", to the front terminal of the crystal mixer CRI.

Couple the signal generator loosely to 1st picture IF amplifier grid in order to obtain markers.

Retouch 1T109, 1T110 and 1T111, 3rd, 4th and 5th picture IF transformers, for maximum gain and overall curve shape as shown in figure 27. It is important that the overall response conforms to curve shape as shown, with the markers placed exactly as indicated.

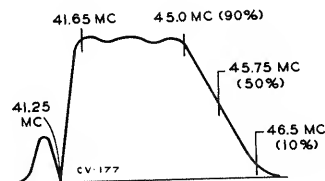


Figure 27—Overall IF Response

KRK12C TUNER ALIGNMENT

TUNER VHF ALIGNMENT—Connect the VHF sweep generator to the antenna terminals. In order to prevent coupling reaction from the sweep generator, it is advisable to employ a resistance pad between the antenna terminals and the generator. Figure 28 shows three different resistance pads for use with sweep generators with 50 ohm co-ax output, 72 ohm co-ax output or 300 ohm balanced output. Choose the pad to match the output impedance of the particular sweep generator employed.

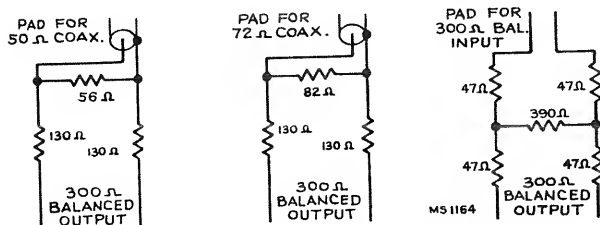


Figure 28—Sweep Attenuator Pads

Couple the VHF signal generator loosely to the antenna terminals. Connect the oscilloscope through the preamplifier, if needed with oscilloscope used, to test point TP1. Connect the potentiometer arm of the 7.5 volt bias supply to the AGC

terminal on the tuner and ground the battery positive terminal to the tuner case. Adjust the bias potentiometer to produce -2.0 volts of bias as measured by the "VoltOhmyst" at the AGC terminal on the tuner. Remove V2, RF oscillator tube, from its socket. This is required because of RF-IF interaction when a crystal is used as a mixer.

Set the channel selector and the sweep generator to channel 2.

Insert markers of channel 2 picture carrier and sound carrier, 55.25 mc and 59.75 mc.

Adjust antenna T6, r-f amplifier plate L29 and mixer L30 adjustments for a symmetrical curve with maximum gain at the center of the pass band. The curves will have a deep valley because of no crystal loading and nonlinear detector characteristics. The limits for the 100% response points are shown in figure 29. The proper curve shape is shown in figure 29(b). (Refer to note on page 25 for detailed explanation of adjustments.) If the bandwidth is out of tolerance, it can usually be corrected by redressing the coupling capacitor of the double tuned circuit, C40 on insert A. Maximum bandwidth occurs when the capacitor is centered in the insert chamber.

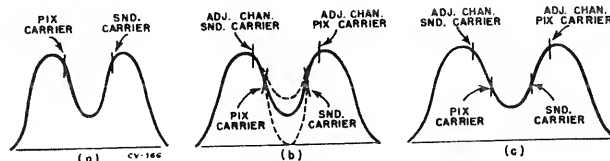


Figure 29—KRK12C VHF Insert Response

Repeat the above steps for all VHF channels adjusting the appropriate antenna, r-f amplifier plate and mixer slugs for a symmetrical curve with maximum gain at the center of the pass band.

Turn off the sweep generator.

Remove the oscilloscope and preamplifier if used, from test point TP1.

Replace the RF oscillator tube V2 in its socket.

Connect the potentiometer arm of the 15 volt bias supply to the junction of 1R178 and 1C169, and ground the positive battery terminal. Adjust the bias potentiometer to produce -9 volts of I-F bias as indicated on the "VoltOhmyst" at the junction point.

Connect the oscilloscope to 1TP101. Use volts peak-to-peak output on the oscilloscope.

Turn the channel selector to channel 13.

Set the fine tuning control to the center of its range.

Adjust the oscillator slug L22 to proper frequency, 257 mc. This may be done in several ways. The easiest way and the way which will be recommended in this procedure will be to use the signal generator as a heterodyne frequency meter and beat the oscillator against the signal generator. To do this tune the signal generator to 257 mc (or to one-fourth the oscillator frequency, 64.25 mc) with crystal accuracy. Insert one end of a piece of insulated wire into the tuner through either of the two holes next to the oscillator tube on the right front top corner of the tuner. Be careful that the wire does not touch any of the tuned circuits as it may cause the frequency of the oscillator to shift. Connect the other end of the wire to the "r-f in" terminal of the signal generator. Adjust L22 oscillator slug to obtain an audio beat with the signal generator.

Turn on the sweep generator and set to channel 13. Adjust T1 for maximum gain on the oscilloscope. Adjust mixer tank circuit L21 for maximum gain and flat-topped curve. Recheck T1 for maximum gain at center of band with the proper response. Maximum gain and flat-topped response should be obtained simultaneously.

Adjust the oscillator to frequency on all VHF channels by switching the receiver and signal generator to each VHF channel and adjusting the appropriate oscillator slug to obtain an audio beat with the signal generator. Adjust the appropriate mixer slug where necessary to obtain maximum gain and proper curve shape as explained above. Do not readjust T1.

Adjust the tunable I-F Trap C16-L7. To do this connect the signal generator to the fixed I-F Trap C2-L2 at the end opposite the antenna terminal plug. Set the signal generator to 43.5 mc and adjust the output of the signal generator to obtain sufficient indication on the oscilloscope. Tune the I-F Trap C16-L7 for minimum indication on the oscilloscope.

Remove the signal generator and the oscilloscope.

TUNER UHF ALIGNMENT.—To align the UHF inserts:

Remove the R-F oscillator tube V2 from its socket.

Connect the potentiometer arm of the 15 volt bias supply to the junction point of 1R178 and 1C169, and ground the positive battery terminal. Adjust the bias potentiometer to produce —9 volts of I-F bias as indicated on the "VoltOhmyst" at the junction point.

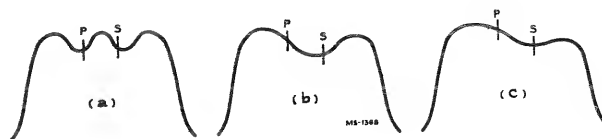


Figure 31—KRK12C UHF Insert Responses

Connect the oscilloscope, through the preamplifier if needed with oscilloscope used, to test point TP1.

Connect the UHF sweep generator to the antenna terminals. Use a 10DB attenuator pad to assure proper alignment.

Connect the UHF signal generator loosely to the antenna terminals.

Set the channel selector to the desired channel and the sweep generator to sweep the frequency of the insert being used.

Insert markers of the picture carrier and sound carrier frequencies for the desired channel (see Table on page 16).

Adjust the UHF antenna, link coupling and mixer adjustments for a symmetrical curve, with maximum gain centered about the pass band.

The responses are shown in figure 31. The curve shape will usually vary from figure 31(a) to figure 31(c) going higher in frequency; however any of these responses is acceptable.

Repeat the above steps for all UHF inserts used, adjusting the appropriate antenna, link coupling and mixer slugs for a symmetrical curve with maximum gain centered about the pass band.

Remove the oscilloscope and preamplifier, if used from test point TP1.

Replace the RF oscillator tube V2 in its socket.

Connect the oscilloscope to test point T1P101. Use 6 volts peak-to-peak on the oscilloscope.

Turn the channel selector to the lowest UHF channel to be used, and set the fine tuning control to the center of its range.

Adjust the oscillator core to proper frequency. To do this, connect the VHF signal generator to test point TP1 with the shortest leads possible. Insert a 45.75 mc marker from the VHF generator.

Set the UHF sweep generator to sweep the desired channel, and observe the output on the oscilloscope. If the sweep generator is not sweeping the correct frequency range, it may be necessary to readjust the sweep in order to place the 45.75 mc marker on the response curve as in figure 27.

Set the UHF marker generator to the picture carrier of the channel insert being adjusted and connect to test point TP1.

Adjust the oscillator core until the markers for 45.75 mc and the picture carrier coincide on the sweep pattern on the oscilloscope.

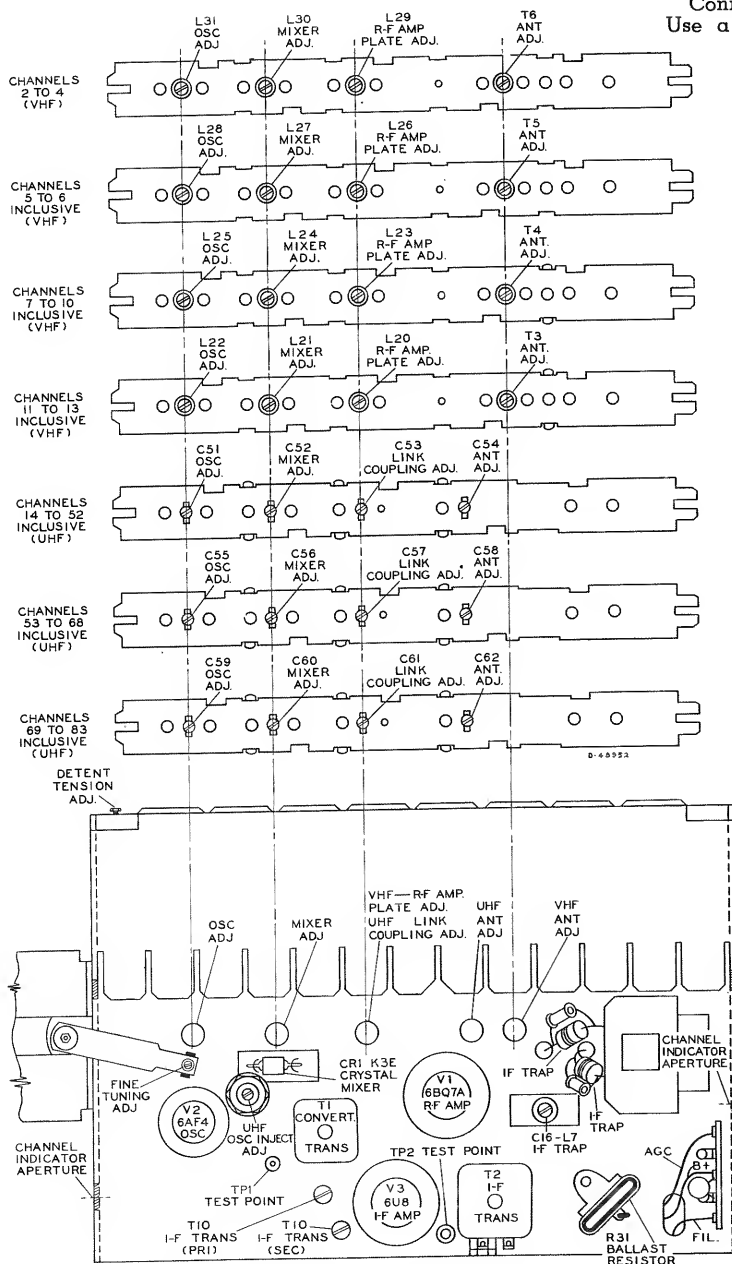


Figure 30—KRK12C Tuner Adjustments

Adjust the mixer core for maximum gain with proper wave shape.

Connect the "VoltOhmyst" to test point TP1, using 1.5 volt DC scale.

Set the oscillator injection adjustment to read .1 volt on the "VoltOhmyst".

Repeat the above steps for all UHF inserts adjusting the oscillator injection control only if the reading on the "VoltOhmyst" exceeds .3 volts. Adjust as necessary to read .3 volts or less at TP1.

Remove all the test equipment employed for tuner alignment.

VIDEO TRAP ADJUSTMENT

Short the grid, pin 2 of V113, 5TH PICTURE IF AMPLIFIER, with a short jumper to ground.

Ground the junction of 2R310 and 2C259, in the plate circuit of V112B Killer, with a short jumper.

Connect the VHF signal generator to the grid of the 1st Video Amplifier, pin 2 of V114, and set the generator to 4.5 mc with internal modulation of the generator.

Connect the oscilloscope, using the oscilloscope diode probe, to the junction of 2C262, 2L121 at the top of 2R317 (COLOR control).

Turn the ganged contrast control 2R204/2R210 to the maximum clockwise position.

Adjust 2L108, the 4.5 mc trap in the cathode circuit of V114, 1st Video Amplifier, for minimum 4.5 mc indication on the oscilloscope.

Remove the two jumpers, the oscilloscope and the signal generator.

(100% Saturated Color Bar Signal Being Used)

Connect the wide band oscilloscope to the kinescope grids at the terminals on the rear of the chassis and adjust 2L140, the 3.58 mc trap for minimum color sub-carrier indication in the video signal.

(Method without 100% Saturated Color Bar Signal and Wide Band Oscilloscope)

Ground the grid, pin 2 of V113, the 5th Picture IF Amplifier, at the tube socket. This will prevent noise from the second detector appearing on the oscilloscope presentations to be observed.

Connect the sweep generator, in series with the absorption type video marker box and a .1 mfd capacitor, to the grid of the 1st Video Amplifier. Set for Video Sweep; i.e. 0-5 mc.

Connect the oscilloscope, using the diode probe, to the junction of 2L112, 2R216 and 4R224 (plate circuit of V115A—2nd Video Amplifier) at the peaking coil 2L112.

Turn the Contrast control fully clockwise.

Increase the sweep output to raise the 3.58 mc. portion of the trace on the oscilloscope above the base line.

Adjust 2L140, the 3.58 mc. trap to coincide with the 3.58 mc marker from the marker box. See figure 32.

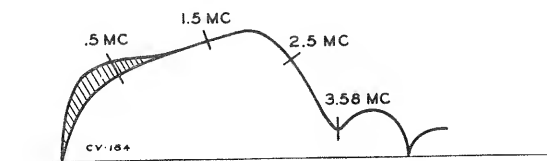


Figure 32—3.58 MC Trap Adjustment

At this point it is advisable to check for proper overall response to kinescope grids and "I" and "Q" channel responses. (Although these circuits are not adjustable their proper operation can be determined by observing their responses.)

Disable the 3.58 mc. oscillator, V131 B, by removing 2Y101, the 3.58 mc. crystal.

Turn the Color control fully counter-clockwise.

Connect the oscilloscope, using the diode probe, to each of the kinescope grids and check the response. Reduce the

output of the sweep generator to prevent over load. The response should correspond to the curve shown in figure 33.

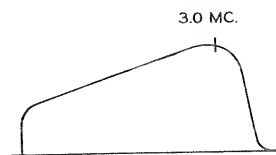


Figure 33—Overall Response at Kinescope Grids

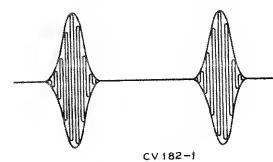


Figure 34—Burst

Move the oscilloscope and diode probe to the test point 2TP103 at the "I" Phase Splitter cathode.

Connect the sweep generator to the "I" Demodulator grid, pin 1 of V132.

Turn the Color control fully clockwise.

Check the "I" channel response for proper wave shape as shown in figure 35.

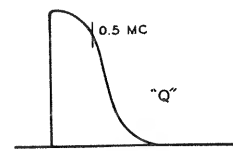
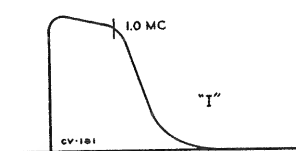


Figure 35—"I" and "Q" Channel Responses

Connect the sweep generator to the "Q" Demodulator grid, pin 1 of V133, and move the oscilloscope and diode probe to test point 2TP102, at the "Q" Phase Splitter cathode. Check the "Q" channel response as shown in figure 35.

Replace 2Y101, the 3.58 mc. crystal. Remove the sweep generator and marker box and the oscilloscope and diode probe. Restore the connection to pin 2 of V114.

1ST VIDEO AMPLIFIER AND BAND PASS AMPLIFIER ALIGNMENT

Remove the FIFTH PICTURE IF AMPLIFIER tube V113, or short the grid of V113 to ground. Connect the VHF sweep generator to pin 2 of V114, in series with the absorption marker box and a .1 mfd capacitor. Connect the capacitor to the grid of the Video Amplifier. Set the generator for Video Sweep; i.e. 0-5 mc. Connect the oscilloscope, using diode probe, to pin 1 of V133, grid of the "Q" Demodulator.

Turn the Contrast control 2R204/2R210 and the Color control 2R317 to their maximum clockwise position.

Adjust the Band Pass Transformer 2T126 (top and bottom) and 2L121 (top) the Band Pass Secondary Coil, for maximum gain and curve shape as shown in figure 37.

Remove all test equipment. Replace V113 or remove the short on the grid. Turn off the receiver. Replace the fuse 3F101.

(Alternate Method using Television Picture Carrier Signal Generator—with Modulation)

Set the channel selector to channel 4.

Connect the potentiometer arm of the 7.5 volt bias supply to the junction of 1R132 and 1C128, at pins 5 and 6 of V104 1st Audio Amplifier and RF Bias clamp, and ground the positive terminal of the bias supply to the chassis. Set the potentiometer to read -2.0 volts DC on the "VoltOhmyst" at the junction of 1R132 and 1C128.

Connect the potentiometer arm of the 15 volt bias supply to the IF bias buss at the junction of 1R178 and 1C169, and ground the positive terminal of the bias supply to the chassis. Set the potentiometer to read -9.0 volts DC on the "VoltOhmyst" at the junction of 1R178 and 1C169.

Short the terminals of 2L108, the 4.5 mc trap in the cathode circuit of V114, to each other.

Connect the oscilloscope, using the oscilloscope diode probe, to pin 1 of V114, the 1st Video Amplifier.

Connect the generator and modulator to the antenna terminals and set to channel 4. With zero modulation, adjust the output for 3 volts on the "VoltOhmyst" between test point 1TP101, and terminal "E" of 1T113, the second detector transformer.

Modulate with video sweep being careful not to overload.

Couple the VHF signal generator loosely to the 1st picture IF Amplifier grid, and adjust for a 45.75 mc marker.

Adjust the fine tuning control to obtain a beat pattern on the oscilloscope. This sets the oscillator exactly on frequency.

Remove the marker generator from 1st pix IF Amplifier grid.

The response on the oscilloscope should correspond to that shown in figure 36.

Disconnect the oscilloscope and diode probe from pin 1 of V114 and reconnect the oscilloscope, using the diode probe, to pin 2 of V133, the "Q" Demodulator.

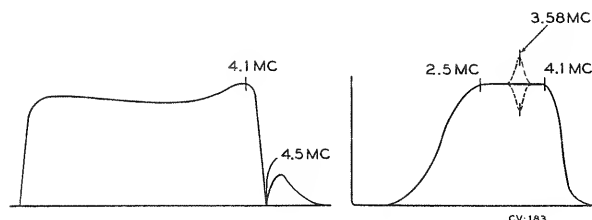


Figure 36—
Overall Response
1st Video

Figure 37—
Overall Band Pass
Response

Remove the short across 2L108 the 4.5 mc trap, at pin 1 of V114.

With a short jumper, ground the junction of 2R310 and 2C259 in the plate circuit of the killer V112B.

Turn the ganged contrast control 2R204/2R210, to its maximum clockwise position.

Adjust 2T126 (top and bottom), the Band Pass Transformer and 2L121 (top), the Band Pass Secondary Coil, for maximum gain and curve shape as shown in figure 37.

NOTE: When using a video sweep generator without internal markers, the VHF signal generator may be employed by loosely coupling to the IF Amplifier and inserting the appropriate IF markers.

Remove the test equipment employed in the preceding adjustments. Turn off the receiver and replace the fuse 3F101.

HORIZONTAL OSCILLATOR ALIGNMENT

The proper functioning of those circuits employing horizontal pulse voltages in their operation, are dependent on the alignment of the Horizontal Oscillator (and Horizontal Deflection) circuit. Also, proper alignment of these circuits, establishes the proper DC current drain for the receiver. Therefore, care should be taken to assure correct circuit adjustment as outlined below.

Tune in a station and synchronize the picture with the horizontal hold control 1R283B.

Preset the horizontal drive control 2R266, on top of the receiver chassis, to the point where the white foldover just disappears from the raster. Set the horizontal locking range trimmer 2C237, on top of the receiver chassis, one-quarter turn from full clockwise. Set the width control 3L120, on the rear of the H.V. compartment, with the adjusting screw approximately two-thirds of the way out.

Set the horizontal hold control 1R283B at the center of its range.

Adjust the horizontal frequency core 2T119 (top), if necessary, to bring the picture into sync horizontally.

Connect the oscilloscope to terminal "C" of 2T119 under the chassis. Adjust waveform 2T119 (bottom) for proper wave shape as shown in figure 38.

Adjust the waveform adjustment core of 2T119 until the two peaks are at the same height. During this adjustment, the picture must be kept in sync by readjusting the hold control if necessary.

This adjustment is very important for correct operation of the circuit. If the broad peak of the wave on the oscilloscope is lower than the sharp peak, the noise immunity becomes poorer, the stabilizing effect of the tuned circuit is reduced and drift of the oscillator may occur. On the other hand, if the broad peak is higher than the sharp peak, the oscillator is over-stabilized, the pull-in range becomes inadequate and the broad peak can cause double triggering of the oscillator when the hold control approaches the clockwise position.

Remove the oscilloscope upon completion of this adjustment.

Set the horizontal hold control to the full counter-clockwise position. Momentarily remove the signal by switching off channel then back. The picture may remain in sync. If so turn the frequency core of 2T119 (top) slightly and momentarily switch off channel. Repeat until the picture falls out of sync with the diagonal lines sloping down to the left. Slowly turn the horizontal hold control clockwise and note the least number of diagonal bars obtained just before the picture pulls into sync.

If more than 3 bars are present just before the picture pulls into sync, adjust the horizontal locking range trimmer 2C237 slightly clockwise. If less than 2 bars are present, adjust 2C237 slightly counter-clockwise. Turn the horizontal hold control counter-clockwise, momentarily remove the signal and recheck the number of bars present at the pull-in point (70° clockwise rotation). Repeat this procedure until 2 or 3 bars are present.

Turn the horizontal hold control to the maximum clockwise position. Adjust the frequency core 2T119 (top) so that the diagonal bar sloping down to the right appears on the screen and then reverse the direction of adjustment so that bar just moves off the screen leaving the picture in synchronization.

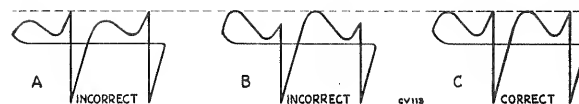


Figure 38—Horizontal Oscillator Waveforms

H.V. ADJUSTMENT

Turn both the ganged Contrast control 2R204/2R210 and the Brightness control 1R124A fully counter-clockwise.

Fasten a short length of HV anode lead to the HV probe of the "VoltOhmyst" and set the "VoltOhmyst" for a 20 KV reading.

Fasten the other end of the short HV anode lead to the corona cup on the base of V121 the HV rectifier. This point is accessible through the hole provided on top of the H.V. compartment for adjustment of 3L139, the Horizontal Dynamic Convergence Adjustment.

Set the H.V. adjustment 3R256, on the rear of the HV compartment, to produce a reading of 19.5 KV on the "VoltOhmyst".

Turn the contrast control 2R204/2R210 and the brightness control 1R124A clockwise until a picture is obtained on the kinescope.

Adjust the focus control 3R259 (lower control on left side of chassis) for best kinescope focus. Adjust the convergence control 3R254 (upper control on left side of chassis) for best convergence in the center area of the kinescope.

Adjust the width control 3L120, on the rear of the HV compartment, to horizontally overscan the viewing area by one-half inch.

Set the horizontal drive control 2R266 on top of the chassis as high as possible without white foldover appearing in the raster.

Re-check the operation of the horizontal hold control (1R283B) to assure that the operation is still proper as previously determined by horizontal oscillator adjustment.

NOTE: To check the performance of the HV circuit, a reading may be taken of V120 the 6BD4 regulator current. Insert a meter in the cathode circuit of the 6BD4. A reading of at least 600 microamperes should be obtained with 19.5 KV of Ultor Anode voltage.

Replacement of the fuse 3F101 should be made only with a 450 MA Type AG fuse.

Adjust the height (1R282A) and the vertical linearity (1R282B) for vertical linearity of the picture making the final adjustments to provide vertical overscan of the viewing area by one-quarter inch at top and bottom.

Remove all test equipment used in the preceding adjustments.

COLOR AFC ALIGNMENT

A color bar signal should be fed to the receiver for AFC alignment. (A transmitted signal may be used if available.)

Connect the Color Bar Generator to the receiver antenna terminals.

Connect the "VoltOhmyst" in series with a calibrated RF Probe (or the Wide Band Oscilloscope) to terminal "B" of 2T128, the 3.58 mc oscillator transformer.

Adjust 2T128 (top) to read 5 volts peak-to-peak on the "VoltOhmyst" or the oscilloscope.

Ground the grid of the burst amplifier, pin 8 of V129 A, with a short jumper.

Connect the "VoltOhmyst" to pins 1-2 of the phase detector V130B.

Adjust the quadrature transformer 2T125 (bottom), for maximum DC reading on the "VoltOhmyst", then adjust 2T125 (top) for minimum DC reading on the "VoltOhmyst".

Remove the jumper shorting the grid (pin 8) of the burst amplifier V129A and set the HUE control to the center of its range.

Adjust 2L141 (top) and the burst amplifier transformer 2T122 (bottom) for maximum DC on the "VoltOhmyst". The burst amplifier transformer 2T122 will tune very broadly and seem to have a flat top. Adjust 2T122 for the maximum reading at the approximate center of the flat top.

NOTE: The Burst signal should be observed at this point. To do this, connect the wideband oscilloscope to pins 1-2 of the phase detector V130B. Check the burst signal, it should conform to figure 34. The burst signal should not change shape when rotating the horizontal hold control over its holding range. Remove the oscilloscope.

Ground the junction of 2L130, 2R340 and 2C275 (in the grid circuit of V131A reactance tube).

Connect the "VoltOhmyst" to pins 1-2 of V130B phase detector and carefully adjust 2T124 (top), Reactance Transformer, for zero beat on the output, which may be observed by a slow swing of the "VoltOhmyst". (Observation may also be made on an oscilloscope or on the kinescope face.)

Remove the short to ground at the junction of 2L130, 2R340 and 2C275 and connect the "VoltOhmyst" to this point.

Shunt the 3.58 mc crystal 2Y101 with a 15 mmf. capacitor.

Adjust the AFC Balance Control 2R306 on top of the receiver chassis for zero reading on the "VoltOhmyst".

Remove the 15 mmf. capacitor shunting the crystal 2Y101 and disconnect the "VoltOhmyst".

DYNAMIC CONVERGENCE CIRCUIT ALIGNMENT

HORIZONTAL—Clip the oscilloscope probe on the insulated lead to pin 13 of the kinescope socket.

Connect a clip lead to the same lead to pin 13 of the Kinescope socket to supply a triggering signal for the oscilloscope.

Turn the vertical convergence amplitude control 1R248A fully counter-clockwise. Set the vertical convergence shape control 1R248B to the center of its range. Turn the horizontal convergence amplitude control 1R238 fully clockwise.

Adjust the horizontal convergence phase control, 1L138 on the front panel of the chassis, for maximum sine wave output on the oscilloscope, as shown in figure 39.

Turn the horizontal convergence amplitude control 1R238 fully counter-clockwise. Adjust the horizontal dynamic convergence adjustment 3L139 on top of the HV compartment for correct phasing of minimum waveform.

The horizontal pulse will appear on top of the sine wave as shown in figure 39.

Turn the horizontal convergence amplitude control 1R238 to its maximum clockwise position and adjust the horizontal convergence phase control 1L138 for correct phasing as above. See figure 39.

Return the horizontal convergence amplitude control 1R238 to its full counter-clockwise position.

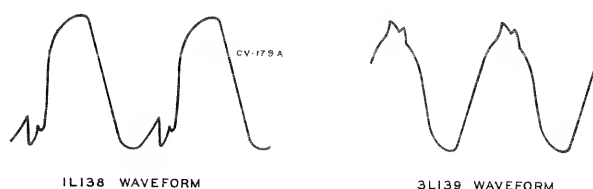


Figure 39—Horizontal Dynamic Convergence Waveforms

VERTICAL—Connect the oscilloscope to the output plate of the vertical convergence amplifier, pin 1 of V119. Adjust the vertical convergence amplitude control 1R248A and the vertical convergence shape control 1R248B for the wave shape shown in figure 40(b).

The amplitude control varies the amplitude of the parabola from 0 to 200 volts peak to peak. The shape control varies the amount of negative or positive sawtooth to the parabola. Make the final adjustment to conform to the waveform in figure 40(b).

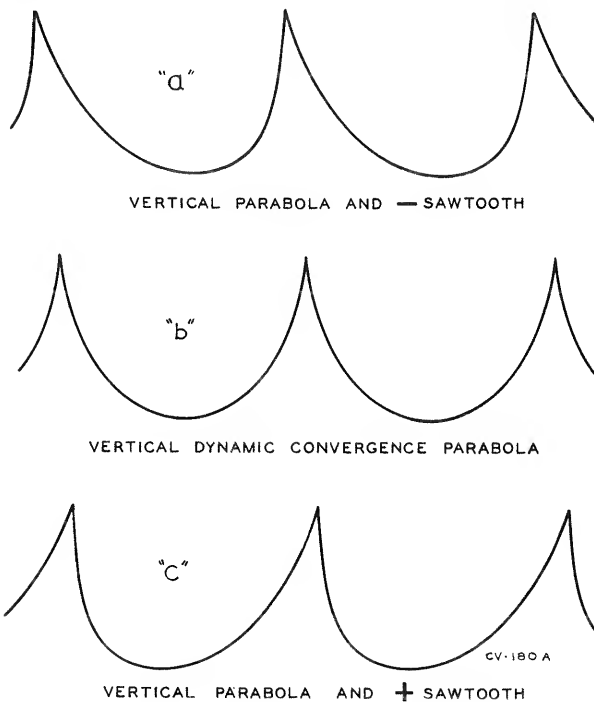


Figure 40—Vertical Dynamic Convergence Waveforms

Clip the oscilloscope probe in series with a high-voltage capacitor to pin 6 of the kinescope. The waveform obtained should conform to that shown in figure 41.

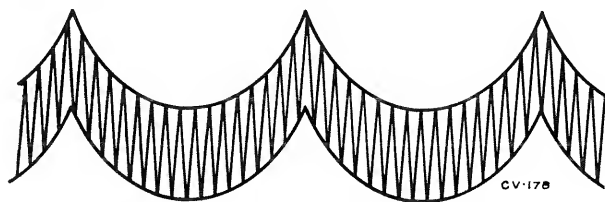


Figure 41—Dynamic Convergence Parabola

Return the vertical convergence amplitude control to minimum.

Disconnect the oscilloscope from the kinescope convergence lead.

MATRIX ALIGNMENT

Turn the color bar generator "on" (allow 5 minute warmup), and connect the "VoltOhmyst" to the metering terminals. Set the metering switch to the "SUB-CARRIER" position and set the "SUB-CARRIER MOD." control to maximum. A reading of -1.2 volts ($\pm 20\%$) should be obtained on the "VoltOhmyst". Set the metering switch to the "SYNC" position and adjust the "BRIGHTNESS MOD." control for a reading of -1.5 volts on the "VoltOhmyst" from the metering terminals.

Depress the "BRIGHTNESS MOD." button. The reading should increase to -1.85 volts. Turn the metering switch to "off".

Connect the "RF OUT." of the color bar generator to the receiver antenna terminals. Turn the channel selector to channel 3 or 4 (whichever crystal has been supplied with the generator) and adjust the "HOR. HOLD" control of the generator until the bar pattern synchronizes on the kinescope.

Adjust the Fine Tuning control until the picture on the kinescope shows no sound interference. Advance the Color control 2R317, until color appears in the bar pattern. If the width and horizontal drive controls are properly adjusted (as explained in Installation Instructions) 10 color bars will be seen on the kinescope.

The normal sequence of the ten bars visible on the Kinescope, starting from the left side, should be as follows. At the extreme left a dull yellow-orange bar, orange, then a bright red, bluish-red, magenta, blue, greenish-blue, cyan, bright bluish-green and ending with a dark green bar at the extreme right.

Connect the oscilloscope to test point 2TP103, "I" Phase Splitter cathode, the signal on the oscilloscope will be the $+$ "I" signal. (See figure 42.)

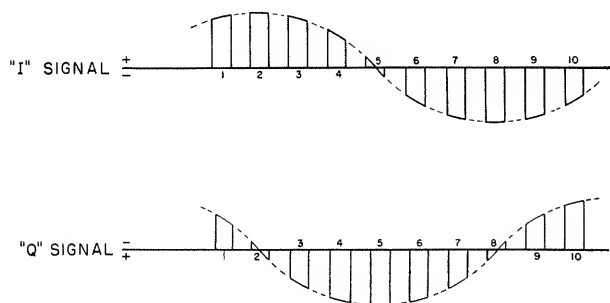


Figure 42—I and Q Waveforms

Set the Hue control, 2C186, to the center of its range, capacitor plates halfway meshed. Then adjust 2L141 until the 5th bar from "Burst" is at the zero axis.

Connect the oscilloscope to 2TP102, "Q" Phase Splitter cathode, and check the pattern. This will be the $-$ "Q" signal on the oscilloscope. The 2nd and 8th bars from burst should be at the zero axis. If not, adjust 2T125 (top) Quadrature Transformer, to bring the 2nd and 8th bars to the zero axis. Recheck the "I" signal and readjust if necessary.

Connect the oscilloscope to the blue kinescope grid, pin 18, at the terminal at the rear of the chassis. (See figure 44.) Adjust the Color control to make the maximum amplitude bar the same amplitude as the sync pulse (in the opposite polarity).

Adjust the "I" Gain control until the 3rd and 10th bars are equal. (Refer to figure 43.)

Move the oscilloscope to the red kinescope grid, pin 3, at the terminal at the chassis rear. The pattern on the oscilloscope should show the 9th bar to be approximately one-half the height of the sync pulse, the 6th bar should be $\frac{1}{2}$ the height of the 5th bar.

Move the oscilloscope to the green kinescope grid, pin 8, at the terminal at the chassis rear. The pattern should show the 4th bar to be approximately one-third the height of the sync pulse, and the 1st and 7th bars should be at the zero axis.

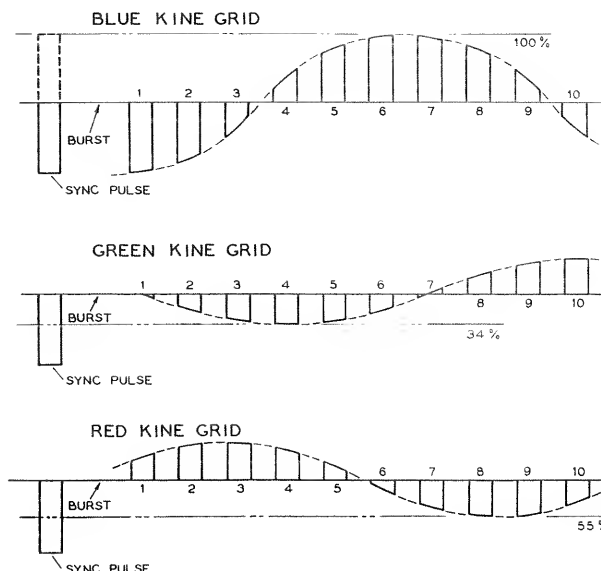


Figure 43—Matrix Waveforms

A reasonable check and adjustment of the matrix set-up of the receiver may be made in the field, by the following method, where an oscilloscope is not readily available.

Turn the color bar generator "on" (allow 5 minute warmup), and connect the "VoltOhmyst" to the metering terminals. Set the metering switch to the "SUB-CARRIER" position and set the "SUB-CARRIER MOD." control to maximum. A reading of -1.2 volts ($\pm 20\%$) should be obtained on the "VoltOhmyst". Set the metering switch to the "SYNC" position and adjust the "BRIGHTNESS MOD." control for a reading of -1.5 volts on the "VoltOhmyst" from the metering terminals.

Depress the "BRIGHTNESS MOD." button. The reading should increase to -1.85 volts. Turn the metering switch to "off".

Connect the "RF OUT." of the color bar generator to the receiver antenna terminals. Turn the channel selector to channel 3 or 4 (whichever crystal has been supplied with the generator) and adjust the "HOR. HOLD" control of the generator until the bar pattern synchronizes on the kinescope.

The normal sequence of the ten bars visible on the Kinescope, starting from the left side, should be as follows. At the extreme left a dull yellow-orange bar, orange, then a bright red, bluish-red, magenta, blue, greenish-blue, cyan, bright bluish-green and ending with a dark green bar at the extreme right.

Adjust the Fine Tuning control until the picture on the kinescope shows no sound interference. Advance the Color control 2R317, until color appears in the bar pattern. If the width and horizontal drive controls are properly adjusted (as explained in Installation Instructions) 10 color bars will be seen on the kinescope.

Set the contrast and brightness controls to normal setting as in reception of a black and white picture.

Set the Color control 2R317 to the center of its range.

Set the Hue control, 2C186, to the center of its range, capacitor plates halfway meshed.

Remove V115, the "Q" Phase Splitter, and observe the bar pattern on the kinescope. Adjust the receiver Brightness, Contrast and Hue controls if necessary. The fifth bar from the left should be the same as the background. If necessary, adjust 2L141 until the center of the fifth bar is equal to the background observed. Replace V115.



the V134, the "I" Phase Splitter, and observe the signal on the Kinescope. Adjust only the receiver Brightness control if necessary. The second and eighth bars should appear the same as the background. If necessary, adjust 2T125 until the centers of the second and eighth bars appear the same as the background observed. Replace V134.

Connect the red and green Kinescope grids to the chassis at the terminals on the rear apron. (See figure 44.) The centers of the second and tenth bars should be at the same blue brightness level. If necessary, readjust the "I" Gain Control to this condition.

Connect the red and blue Kinescope grids to ground. The centers of the first and seventh bars should appear the same as the background brightness level.

Connect the blue and green Kinescope grids to ground. The centers of the third and ninth bars should appear slightly darker than the red background.

Disconnect the short on the Kinescope grids and remove the alignment generator.

Alternate Method for Matrix Alignment (Using 100% Saturated Color Bar Signal)

Matrixing adjustment should be made only after the alignment of the receiver alignment and H.V. Adjustment is completed, with the receiver tuned for an NTSC color bar signal from the station (or provided from another source).

Adjust the contrast control 2R204/2R210 and the Color Control 3P17 to mid-range.

Connect the oscilloscope to test point 2TP103, at the "I" Phase Splitter cathode.

Adjust the Oscilloscope at the horizontal sweep rate by the lead from the oscilloscope to the insulated lead from pin 8 of the yoke plug 3P105B.

The signal on the oscilloscope will be the + "I" signal. Adjust the Hue control 2C186, for correct waveform, which is the point where the "Q" bar is on the "Zero" axis.

Connect the oscilloscope to test point 2TP102, at the "Q" Phase Splitter cathode, trigger the oscilloscope as before.

The signal on the oscilloscope will be the - "Q" signal.

Connect the Quadrature transformer (2T125 top) to place the signal on the zero axis.

Connect the oscilloscope to the blue kinescope grid at the terminal on the rear edge of the chassis. (See figure 39.)

Adjust the Color Saturation control for best cancellation of the green and yellow bars. (Zero base line.)

Adjust the "I" Gain Control for best cancellation of Red.

Repeat the adjustment for green, yellow and red to achieve best cancellation.

Connect the oscilloscope to the green kinescope grid, at rear chassis terminal, and check the cancellation of the red, magenta and blue bars.

Connect the oscilloscope to the red kinescope grid and check the cancellation of the green, blue and cyan bars.

Repeat the matrixing adjustments until the best overall cancellation is obtained.

NOTE ON KRK12C TUNER ALIGNMENT.—The use of a crystal mixer in the KRK12C Tuner makes it necessary to observe the insert responses with the oscillator disabled. This is due to undesirable r-f/i-f interaction if the oscillator was allowed to operate during alignment. Therefore, the responses shown in figure 29 are not a strictly true representation of the insert band pass during actual operation. When an insert is aligned, using an oscilloscope to observe the response, the curve shown in figure 29(b) will be the correct response for reference. In actual operation, the band pass will be such that the sound and picture carriers will be at the tips of the curve. The adjacent channel picture and sound carriers will be in the valleys at each side. Care should be taken not to exceed the limits shown in figures 29(a) and 29(c).

The valley, in the center of the response curve, may vary from 0 to 50% above the base line for VHF inserts. Adjust the output level of the sweep generator to prevent excessive signal input to the tuner. Excessive signal input will be indicated by the valley rising above the 50% level, particularly on the higher VHF channels.

Oscillator injection voltage is not adjusted on VHF inserts. A check may indicate variations from .08 to .3 volts at TP1 but such readings should not be interpreted as an indication of trouble. On UHF channels, however, the injection voltage should be adjusted to fall within the specified limits.

2R204
2R210
VERT.
CENTERING
CONTROL

3P17
WIDTH
CONTROL

3R204
3R210
SC. COVERS
CONTROL

3R209
FOCUS
CONTROL

2TP104
TEST
TERMINAL

26



VOLTAGE CHART

The following measurements represent the following conditions. A 500 microvolt black and white test pattern signal was fed into the receiver, the picture synchronized and the AGC control properly adjusted. Voltages shown are read with a type WV97A Senior "VoltOhmyst" between the indicated terminal and chassis ground and with the receiver operating on 117 volts, 60 cycles, a-c.

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V101	6AU6	1st Sound I-F Amp.	500 Mu. V. Signal	5	144	6	144	7	0.9	1	—	—	—	At min. volume
V102	6AU6	Driver	500 Mu. V. Signal	5	126	6	107	7	0	1	—15	—	—	At min. volume
V103	6AL5	Ratio Detector	500 Mu. V. Signal	7	—	—	—	1	—	—	—	—	—	At min. volume
V104	6AV6	1st Audio Amplifier	500 Mu. V. Signal	7	96	—	—	2	0	1	—0.8	—	—	—
V105	6AQ5	Audio Output	500 Mu. V. Signal	5	261	6	271	2	16	7	—	—	—	—
V109	6DC6	1st Pix I-F Amplifier	500 Mu. V. Signal	5	225	6	225	2	0.34	1	—5.0	—	—	—
V110	6DC6	2nd Pix I-F Amplifier	500 Mu. V. Signal	5	200	6	230	2	0.36	1	—4.8	—	—	—
V111	6DC6	3rd Pix I-F Amplifier	500 Mu. V. Signal	5	190	6	203	2	0.52	1	—2.0	—	—	—
V112A	6AN8	4th Pix I-F Amplifier	500 Mu. V. Signal	6	150	7	150	9	1.9	8	—	—	—	—
V112B	6AN8	Killer	500 Mu. V. Signal	1	—9	—	—	3	0	2	—2.0	—	—	—
V113	6CL6	5th Pix I-F Amplifier	500 Mu. V. Signal	6	200	3-8	200	1	4.4	2	—	—	—	—
V114	6CL6	1st Video Amplifier	500 Mu. V. Signal	6	205	3-8	142	1	2.5	2	—45	—	—	—
V115A	6AN8	2nd Video Amplifier	500 Mu. V. Signal	6	130	7	150	9	20	8	12.0	—	—	—
V115B	6AN8	"Q" Phase Splitter	500 Mu. V. Signal	1	134	—	—	3	19	2	0	—	—	—
V116A	6AN8	Band Pass Amplifier	500 Mu. V. Signal	6	290	7	160	9	0	8	—	—	—	—
V116B	6AN8	Keyer	500 Mu. V. Signal	1	106	—	—	3	22.5	2	11.5	—	—	—
V117A	6AN8	AGC Amplifier	500 Mu. V. Signal	6	—45	7	390	9	285	8	275	—	—	CAUTION Heater at +285 V.
V117B	6AN8	Hor. Sync. Separator	500 Mu. V. Signal	1	385	—	—	3	240	2	202	—	—	
V118A	12AT7	Sync. Amplifier	500 Mu. V. Signal	6	57	—	—	8	0	7	—1.4	—	—	—
V118B	12AT7	Vert. Sync. Separator	500 Mu. V. Signal	1	80	—	—	3	0	2	—18.5	—	—	—
V119	12AU7	Vert. Converg. Amp.	500 Mu. V. Signal	6	195	—	—	8	9.3	7	—	—	—	—
			500 Mu. V. Signal	1	385	—	—	3	20	2	—	—	—	—
V120	6BD4	Shunt Regulator	500 Mu. V. Signal	Cap	19,500	—	—	1-8	390	5	—	—	—	Heater at +285 V.
V121	3A3	H.V. Rectifier	500 Mu. V. Signal	Cap	*	—	—	7	19,500	—	—	—	—	*H.V. Pulse present
V124	1X2B	Focus Rectifier	500 Mu. V. Signal	Cap	*	—	—	1	4,500	—	—	—	—	*H.V. Pulse present
V125	6AU4GT	Damper	500 Mu. V. Signal	5	380	—	—	3	*680	—	—	—	—	*At B boost

Tube No.	
V126	6
V127	6
V127	6
V128	1
V128	1
V129A	6
V129B	6
V130A	6
V130B	6
V131A	6
V131B	6
V132	6
V133	6
V134A	6
V134B	6
V135A	6
V135B	6
V136A	6
V136B	6
V137A	6
V137B	6
V138A	6
V138B	6
V138C	6
V139	6

VOLTAGE CHART

CT-100

Tube No.	Tube Type	Function	Operating Condition	E. Plate		E. Screen		E. Cathode		E. Grid		I Plate (ma.)	I Screen (ma.)	Notes on Measurements
				Pin No.	Volts	Pin No.	Volts	Pin No.	Volts	Pin No.	Volts			
V126	6CD6	Horizontal Output	500 Mu. V. Signal	Cap	—	8	155	3	0	5	—40	—	—	—
V127	6SN7	Horizontal Oscillator	500 Mu. V. Signal	5	230	—	—	6	0	4	—65	—	—	—
V127	6SN7	Horizontal Osc. Control	500 Mu. V. Signal	2	255	—	—	3	6.0	1	—18.0	—	—	—
V128	12BH7	Vertical Oscillator	500 Mu. V. Signal	1	126	—	—	3	0	2	—25	—	—	—
V128	12BH7	Vertical Output	500 Mu. V. Signal	6	310	—	—	8	14.6	7	0	—	—	—
V129A	6AN8	Burst Amplifier	500 Mu. V. Signal	6	280	7	290	9	22.5	8	0	—	—	—
V129B	6AN8	Phase Detector	500 Mu. V. Signal	1	—	—	—	3	18.5	2	—	—	—	—
V130A	6AN8	Quad. 3.58 MC. Amp.	500 Mu. V. Signal	6	192	7	140	9	2.45	8	—	—	—	—
V130B	6AN8	Phase Detector	500 Mu. V. Signal	1	—19	—	—	3	—	2	—19	—	—	—
V131A	6AN8	Reactance	500 Mu. V. Signal	6	285	7	97	9	2.9	8	—0.52	—	—	—
V131B	6AN8	3.58 MC. Oscillator	500 Mu. V. Signal	1	97	—	—	3	—	2	—11	—	—	—
V132	6BY6	"I" Demodulator	500 Mu. V. Signal	5	210	6	72	2	1.2	1&7	—	—	—	—
V133	6BY6	"Q" Demodulator	500 Mu. V. Signal	5	220	6	74	2	1.4	1&7	—	—	—	—
V134A	6AN8	"I" Amplifier	500 Mu. V. Signal	6	165	7	135	9	2.8	8	1.2	—	—	—
V134B	6AN8	"I" Phase Splitter	500 Mu. V. Signal	1	185	—	—	3	37	2	31	—	—	—
V135A	12BH7	Green Adder	500 Mu. V. Signal	6	162	—	—	8	7.5	7	3.0	—	—	—
V135B	12BH7	Green Output	500 Mu. V. Signal	1	215	—	—	3	7.0	2	0	—	—	—
V136A	12BH7	Blue Adder	500 Mu. V. Signal	6	150	—	—	8	7.5	7	3.0	—	—	—
V136B	12BH7	Blue Output	500 Mu. V. Signal	1	215	—	—	3	7.4	2	0	—	—	—
V137A	12BH7	Red Adder	500 Mu. V. Signal	6	168	—	—	8	7.5	7	2.8	—	—	—
V137B	12BH7	Red Output	500 Mu. V. Signal	1	215	—	—	3	6.8	2	0	—	—	—
V138A	6BC7	Green D.C. Restorer	500 Mu. V. Signal	8	62	—	—	9	83	—	—	—	—	—
V138B	6BC7	Blue D.C. Restorer	500 Mu. V. Signal	6	62	—	—	7	85	—	—	—	—	—
V138C	6BC7	Red D.C. Restorer	500 Mu. V. Signal	2	52	—	—	1	76	—	—	—	—	—
V139	15GP22	Kinescope	500 Mu. V. Signal	Ultor Anode	19,500	—	—	—	—	—	—	—	—	—

TUNER SCHEMATIC

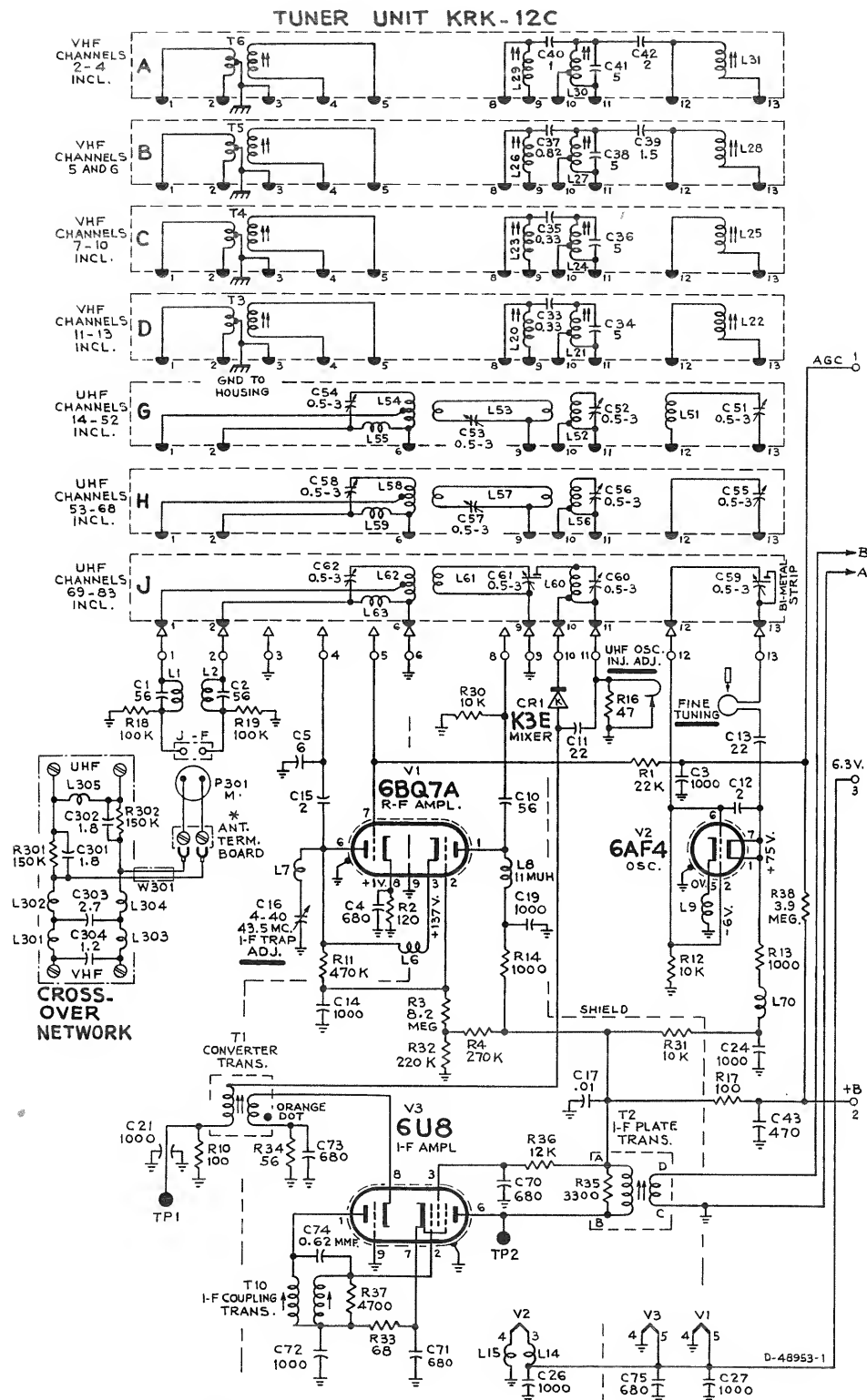
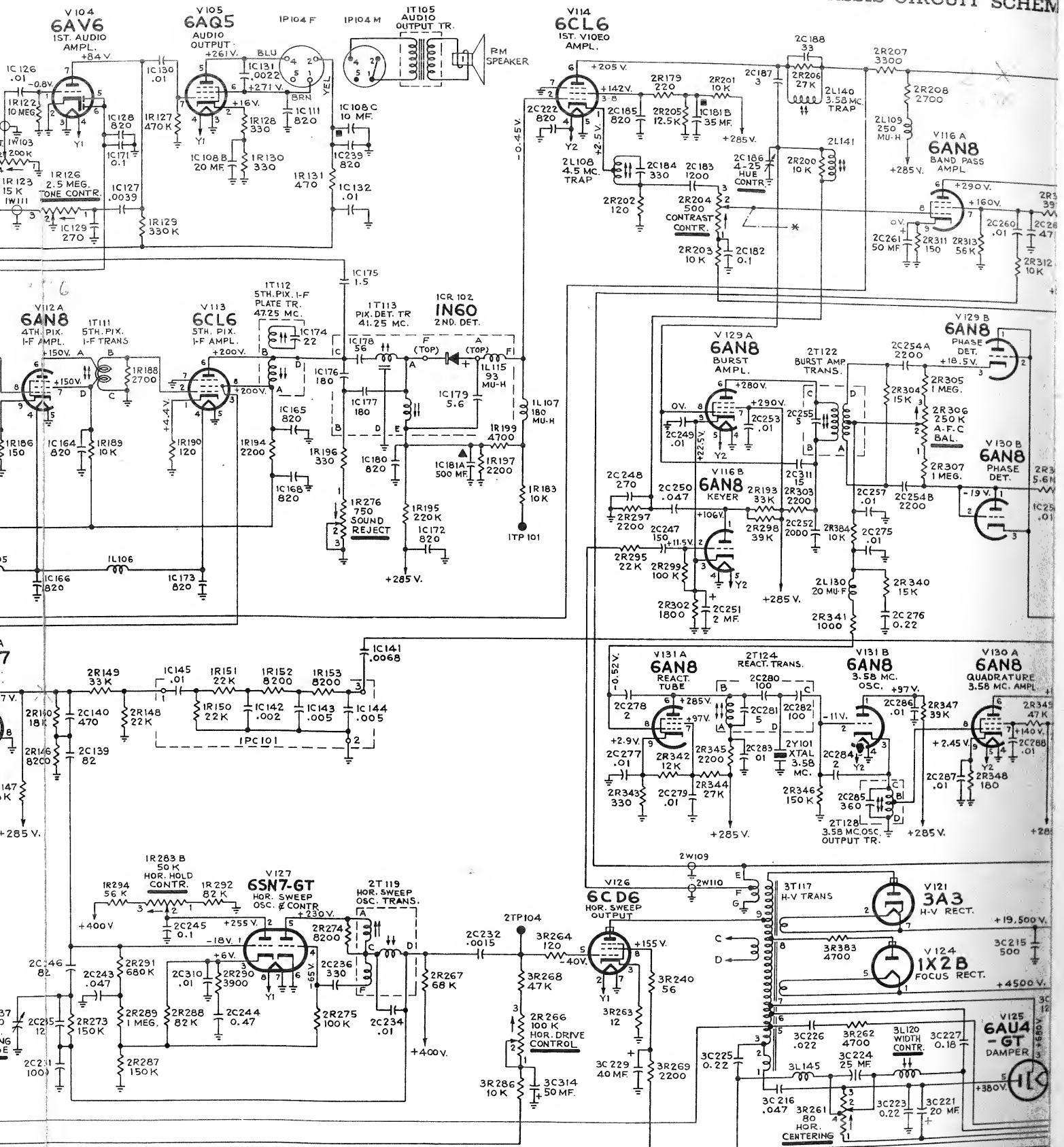


Figure 46—KRK12C Schematic Diagram

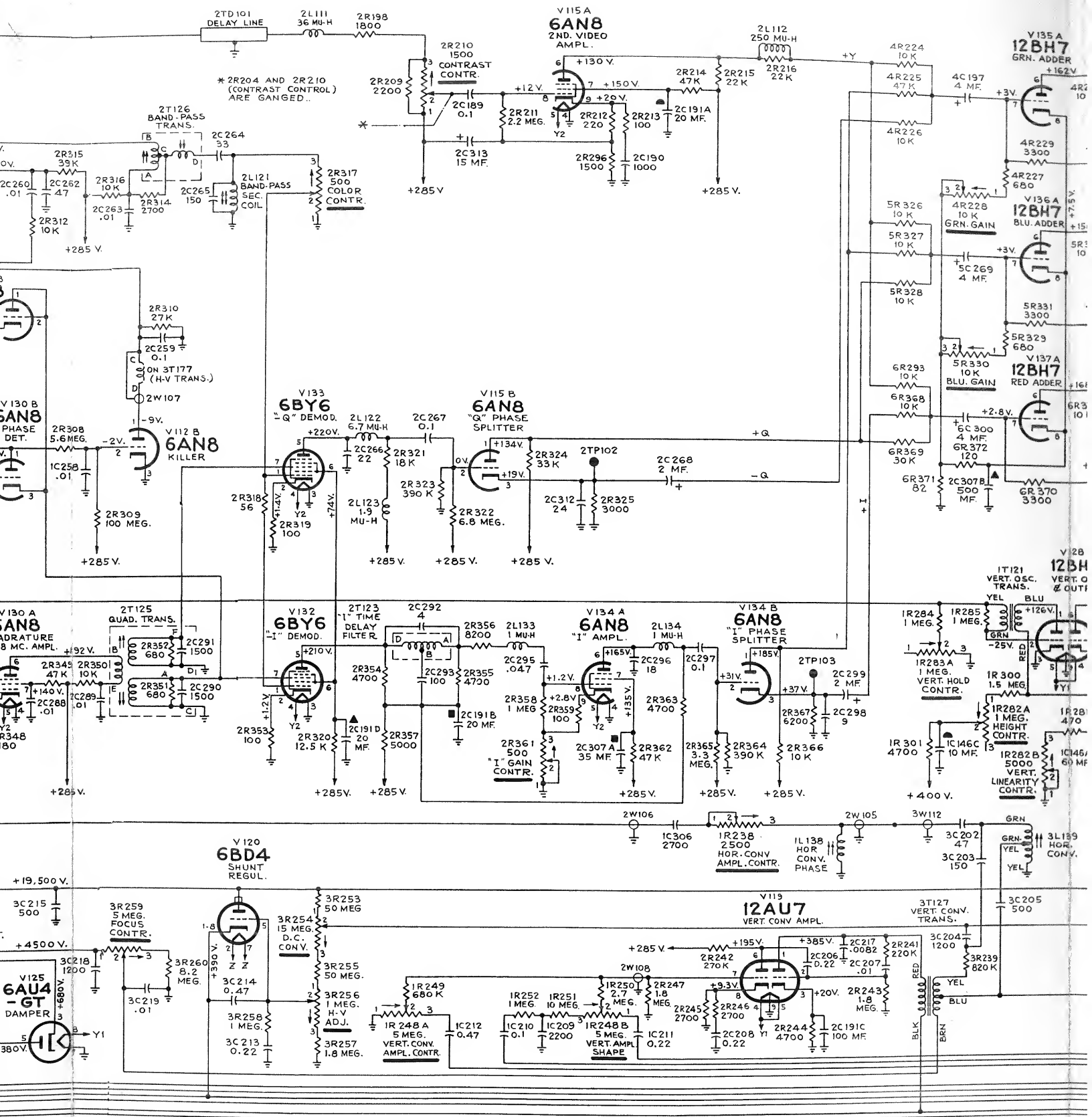
CHASSIS CIRCUIT SCHEM



All capacitance values less than 1 in MF and above 1 in MMF unless otherwise noted. All resistance values in ohms. K=1000.

Direction of arrows at con clockwise rotation.

rows at controls indicates



All voltages measured with "VoltOhmyst" and with a 500 ΩV black and white test signal. Voltages should hold within $\pm 20\%$ with 117 v. a-c supply.

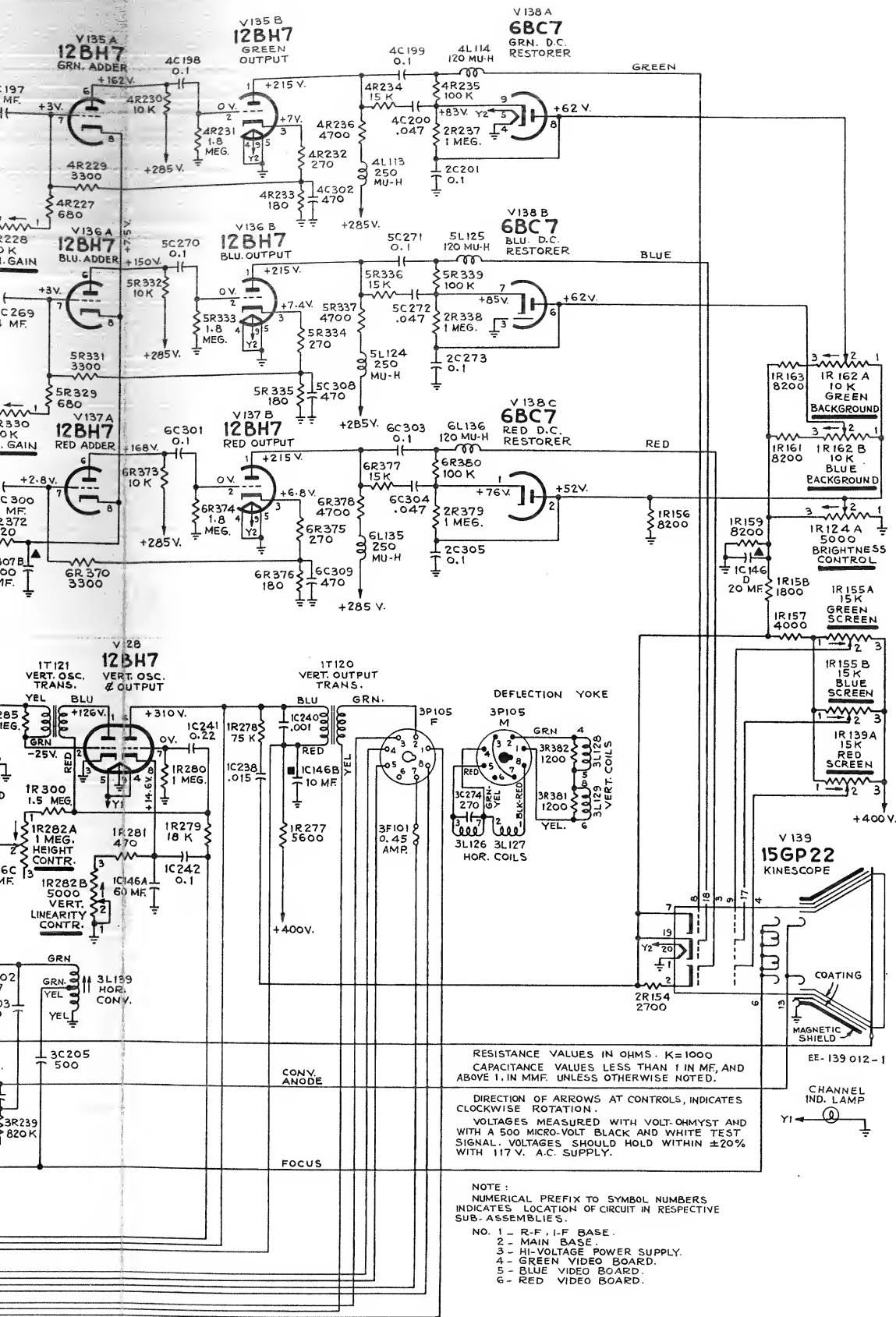


Figure 47—Circuit Schematic Diagram Model CT-100

SYMBOL NO.	STOCK NO.	DESCRIPTION	SYMBOL NO.	STOCK NO.	DESCRIPTION
KRK 12C TUNER ASSEMBLIES					
C1		Part of L1	R12	5033 10	Resistor — Fixed, composition: — 10,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C2		Part of L2	R13, R14	5032 10	Resistor—Fixed, composition:—1000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C3	776 15	Capacitor—Ceramic, stand-off, 1000 mmf.	R15		Not used
C4	77624	Capacitor—Fixed, ceramic, 680 mmf., $\pm 100\%$, —0%, 500 volts D.C. High "K" disc	R16	503047	Resistor—Fixed, composition:—47 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C5	74 182	Capacitor—Fixed, ceramic, non-insulated, 6 mmf., ± 0.5 mmf., 500 volts D.C. Temp. coeff. —750	R17		Same as R10
C10	71924	Capacitor—Fixed, ceramic, non-insulated, 56 mmf., $\pm 10\%$, 500 volts D.C. Temp. coeff. —750	R18, R19	5034 10	Resistor — Fixed, composition: — 100,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C11	77621	Capacitor—Fixed, ceramic, crystal holder, 22 mmf., $\pm 10\%$, Temp. coeff. —750	R30	5033 10	Resistor — Fixed, composition: — 10,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C12, C13	77667	Capacitor—Fixed, ceramic, insulated comprising: 1 section of 2 mmf., and 1 section of 22 mmf. Temp. coeff. —750	R31	79337	Resistor—Wire wound:—10,000 ohms, $\pm 5\%$, 10 watts
C14	77252	Capacitor—Fixed, ceramic, 1000 mmf., $\pm 100\%$, —0%, 500 volts D.C. High "K" disc	R32	502422	Resistor — Fixed, composition: — 220,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C15	77210	Capacitor—Fixed, ceramic, non-insulated, 2 mmf., ± 0.25 mmf., 500 volts D.C.	R33	503068	Resistor—Fixed, composition:—68 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C16	776 16	Capacitor—Adjustable mica, 4-40 mmf.	R34	503056	Resistor—Fixed, composition:—56 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C17	73960	Capacitor—Fixed, ceramic, 10,000 mmf., $\pm 100\%$, —0%, 500 volts D.C. High "K" disc	R35		Part of T2
C18		Not used	R36	5033 12	Resistor — Fixed, composition: — 12,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C19		Same as C3	R37	503247	Resistor—Fixed, composition:—4700 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
C20		Same as C14	R38	502539	Resistor — Fixed, composition: — 3.9 megohms, $\pm 5\%$, $\frac{1}{2}$ watt
C21	77084	Capacitor—Ceramic, feed-thru, 1000 mmf.		77580	Ball—Steel ball (.125" dia.) (12 req'd)
C22, C23		Not used		77579	Ball—Steel ball (.187" dia.)
C24		Same as C3		77589	Bracket—Lamp bracket
C25		Not used		78971	Cam—Tuner adjustment cam
C26		Same as C3		78963	Connector—Connector and bracket assembly female 2 contact
C27		Same as C14		77633	Connector—Formed grounding connector
C28 to C32 Incl.		Not used		78601	Contact—Bracket and spring contact assembly for antenna secondary ground for units stamped KRK12C
C33, C34		Part of 77605		77612	Contact—Bracket and spring contact assembly for grounding rotor—assembled to base
C35, C36		Part of 77604		77618	Contact—Bracket and spring contact assembly for grounding rotor—assembled to oscillator shield
C37, C38, C39		Part of 77603		78604	Contact—Contact and support assembly complete with one (1) contact
C40, C41, C42		Part of 77602		77606	Contact—Contact and support assembly complete with two (2) contacts and UHF antenna input connector
C43	77293	Capacitor—Fixed, ceramic, 470 mmf., $\pm 100\%$, —0%, 500 volts D.C. High "K" disc		77620	Contact—Contact and support assembly complete with four (4) contacts and holder for crystal rectifier
C70, C71	77624	Capacitor—Fixed, ceramic, 680 mmf., $\pm 100\%$, —0%, 500 volts D.C. High "K" disc		77607	Contact—Contact and support assembly complete with five (5) contacts—rear chassis
C72		Same as C3		77617	Control—UHF oscillator injection adjustment control
C73		Same as C70		78975	Core—Fine tuning core
C74	79166	Capacitor—Headed lead type, 0.62 mmf., $\pm 5\%$, 500 volts D.C.		77986	Gear—Rotor drive gear—nylon—32 teeth
C75		Same as C70		77602	Insert—VHF coil assembly insert—for channels 2, 3, or 4 (includes C40, C41, C142, L29, L30, L31, T6)
CR1	78972	Rectifier—Germanium rectifier		77603	Insert—VHF coil assembly insert—for channels 5 or 6 (includes C37, C38, C39, L26, L27, L28, T5)
L1, L2	77626	Trap—L.F. trap		77604	Insert—VHF coil assembly insert—for channels 7, 8, 9 or 10 (includes C35, C36, L23, L24, L25, T4)
L3, L4, L5		Not used		77605	Insert—VHF coil assembly insert—for channels 11, 12 or 13 (includes C33, C34, L20, L21, L22, T3)
L6	77627	Coil—Peaking coil (includes R11)		77590	Lever—Actuating lever for fine tuning link
L7	77628	Coil—L.F. trap		78698	Link—Fine tuning plunger link
L8	77695	Coil—R.F. plate coil		77581	Plate—Front plate and ball race
L9	77629	Coil—Oscillator cathode coil		78967	Plunger—Fine tuning plunger
L10 to L13 Incl.		Not used		78972	Rectifier—Germanium rectifier 3E
L14	77631	Coil—Oscillator heater coil		30340	Retainer—Retainer ring for fine tuning actuating lever stud
L15	77632	Coil—Oscillator heater coil		77574	Rotor—Rotor frame
L16 to L19 Incl.		Not used		78600	Shaft—Channel selector drive shaft complete with two (2) gears for units stamped KRK12C
L20, L21, L22		Part of 77605		78449	Shaft—Indicator shaft
L23, L24, L25		Part of 77604		78964	Shield—Oscillator shield and grounding spring
L26, L27, L28		Part of 77603		77577	Shield—Top shield
L29, L30, L31		Part of 77602		76534	Shield—Tube shield for V1, V3
L70	78224	Coil—Oscillator plate coil		78965	Shield—Tube, 7 pin, miniature, for V3
R1	503322	Resistor—Fixed, composition:—22,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt		78966	Socket—Tube, 7 pin, miniature, saddle mounting
R2	503112	Resistor—Fixed, composition:—120 ohms, $\pm 10\%$, $\frac{1}{2}$ watt		77608	Socket—Tube socket, 9 pin, miniature, saddle mounted, moulded mica for V1, V3, V4
R3	503582	Resistor—Fixed, composition:—8.2 megohms, $\pm 10\%$, $\frac{1}{2}$ watt		78976	Socket—Tube, 9 pin, miniature, mica filled for V3
R4	503427	Resistor — Fixed, composition: — 270,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt		78342	Spring—Channel selector drive shaft coil spring
R5 to R9 Incl.		Not used		78246	Spring—Fine tuning link adjusting spring
R10	503110	Resistor—Fixed, composition:—100 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
R11		Part of L6			

SYMBOL NO.	STOCK NO.	DESCRIPTION	SYMBOL NO.	STOCK NO.	DESCRIPTION
	77578	Spring—Formed spring for holding rotor (on back of unit)	IC212	78977	Capacitor—Fixed, paper, oil impregnated, 0.47 mf., $\pm 20\%$, 400 volts
	77598	Spring—Rotor detent spring and roller complete with mounting bracket	IC238	78978	Capacitor—Fixed, paper, oil impregnated, .015 mf., $\pm 20\%$, 600 volts
	77587	Stud—Mounting stud for fine tuning link actuating lever	IC239		Same as IC128
	76460	Terminal—Test point terminal	IC240	78980	Capacitor—Fixed, paper, oil impregnated, .001 mf., $\pm 10\%$, 1600 volts
	77585	Washer—"C" washer for drive and indicator shafts (3 req'd)	IC241		Same as IC211
	74623	Washer—#8-32 washer for rotor adjustment spring	IC242		Same as IC171
			IC258		Same as IC110
			IC306	39662	Capacitor—Fixed, mica, 2700 mmf., $\pm 5\%$, 500 volts
					Part of 1T102
			ICR101, } ICR102 }		
			IL102	78945	Coil—Choke coil
			IL103 to IL106 incl.	73477	Coil—Choke coil
			IL107		
			IL115	74214	Coil—Peaking, 180 millihenries
			IL116		Part of 1T113
			IL138		Part of 1T102
			IPC101	78998	Coil—Horizontal convergence phase
				79246	Circuit—Printed Circuit including IC142 to IC145 incl. and IR150 to IR153 incl.
			IR108	523322	Resistor—Fixed, composition, 22,000 ohms, $\pm 10\%$, 2 watts
			IR109	502082	Resistor—Fixed, composition, 82 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR110	503515	Resistor—Fixed, composition, 1.5 megohm, $\pm 10\%$, $\frac{1}{2}$ watt
			IR111		Same as IR108
			IR112	503347	Resistor—Fixed, composition, 47,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR114	503318	Resistor—Fixed, composition, 18,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR116	523356	Resistor—Fixed, composition, 56,000 ohms, $\pm 10\%$, 2 watts
			IR117	502047	Resistor—Fixed, composition, 47 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR118	502310	Resistor—Fixed, composition, 10,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR119	503339	Resistor—Fixed, composition, 39,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR120	502212	Resistor—Fixed, composition, 1200 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR121	502210	Resistor—Fixed, composition, 1000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR122	503610	Resistor—Fixed, composition, 10 megohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR123	503315	Resistor—Fixed, composition, 15,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR124-A, B	78940	Control—"On-Off" volume and brightness control
			IR125		Same as IR118
			IR126	78941	Control—Tone control
			IR127	503447	Resistor—Fixed, composition, 470,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR128	76465	Resistor—Fixed, wire wound, 330 ohms, $\pm 10\%$, 1 watt
			IR129	503433	Resistor—Fixed, composition, 330,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR130		Same as IR128
			IR131	523147	Resistor—Fixed, composition, 470 ohms, $\pm 10\%$, 2 watts
			IR132	502456	Resistor—Fixed, composition, 560,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR137	502447	Resistor—Fixed, composition, 470,000 ohms, $\pm 5\%$
			IR138	502482	Resistor—Fixed, composition, 820,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR139-A, B	78938	Control—Red screen and A.G.C. control
			IR150, } IR151, } IR152, } IR153 }		Part of IPC101
			IR155-A, B	78939	Control—Blue screen and green screen control
			IR156	76504	Resistor—Fixed, wire wound, 8200 ohms, $\pm 10\%$, 2 watts
			IR157	78907	Resistor—Fixed, wire wound, 4000 ohms, $\pm 5\%$, 5 watts
			IR158	78932	Resistor—Fixed, wire wound, 1800 ohms, $\pm 10\%$, 2 watts
			IR159		Same as IR156
			IR161		Same as IR156
			IR162-A, B	78935	Control—Green and blue background control
			IR163		Same as IR156
			IR164	502327	Resistor—Fixed, composition, 27,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR165	503210	Resistor—Fixed, composition, 1000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
			IR166	78933	Control—Sound rejection or sound level control
			IR167	502133	Resistor—Fixed, composition, 330 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR168	3579	Resistor—Fixed, composition, 62 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
			IR169	513347	Resistor—Fixed, composition, 47,000 ohms, $\pm 10\%$, 1 watt
			IR170	523310	Resistor—Fixed, composition, 10,000 ohms, $\pm 10\%$, 2 watts
IC108-A, } B, C }	78929	Capacitor—Fixed, electrolytic, 10-10-20 mfd., -10 , $+50$, $+50$, $+250\%$, 450-450-25 volts D.C.			
IC109		Part of 1T102			
IC110	73960	Capacitor—Fixed, ceramic, .01 mf., $+100\%$, -0% , 500 volts			
IC111		Same as IC128			
IC112, } IC113 }		Part of 1T103			
IC114	39664	Capacitor—Fixed, mica, 3300 mmf., $\pm 5\%$, 500 volts			
IC115	71924	Capacitor—Fixed, ceramic, 56 mmf., $\pm 5\%$, 500 volts			
IC117-A, B	75877	Capacitor—Fixed, ceramic, .01—.01 mf., $+100\%$, -0% , 500 volts			
IC118		Part of 1T104			
IC120	73595	Capacitor—Fixed, paper, oil impregnated, .0022 mf., $\pm 20\%$, 600 volts			
IC121, } IC122 }	98414	Capacitor—Fixed, mica, 390 mmf., $\pm 5\%$, 500 volts			
IC123	78943	Capacitor—Fixed, electrolytic, 5 mf., $+100\%$, -10% , 50 volts			
IC124	58476	Capacitor—Fixed, paper, oil impregnated, .018 mf., $\pm 10\%$, 400 volts			
IC125, } IC126 }	73561	Capacitor—Fixed, paper, oil impregnated, .01 mf., $\pm 20\%$, 400 volts			
IC127	78221	Capacitor—Fixed, paper, oil impregnated, .0039 mf., $\pm 10\%$, 600 volts			
IC128	78944	Capacitor—Fixed, ceramic, 820 mmf., $\pm 20\%$, 500 volts			
IC129	39638	Capacitor—Fixed, mica, 270 mmf., $\pm 5\%$, 500 volts			
IC130	73594	Capacitor—Fixed, paper, oil impregnated, .01 mf., $\pm 20\%$, 600 volts			
IC131	73817	Capacitor—Fixed, paper, oil impregnated, .0022 mf., $\pm 20\%$, 1600 volts			
IC132		Same as IC110			
IC141	73807	Capacitor—Fixed, paper, oil impregnated, .0068 mf., $\pm 20\%$, 600 volts			
IC142 to IC145 incl. }		Part of IPC101			
IC146-A, } B, C, D }	78931	Capacitor—Fixed, electrolytic, 10-10-10-60 mfd., -10 , $+50$, $+50$, $+100$, $+250\%$, 450-450-150-25 volts D.C.			
IC147		Same as IC128			
IC148		Part of 1T106			
IC149, } IC150 }		Part of 1T106			
IC151, } IC152 }		Same as IC128			
IC153		Part of 1T107			
IC154, } IC155 }		Part of 1T108			
IC156		Same as IC128			
IC158, } IC159 }					
IC160					
IC161	78905	Capacitor—Fixed, paper, oil impregnated, 0.22 mf., $\pm 20\%$, 200 volts			
IC162 to IC169 incl. }		Same as IC128			
IC171	73551	Capacitor—Fixed, paper, oil impregnated, 0.1 mf., $\pm 20\%$, 400 volts			
IC173		Same as IC128			
IC174		Part of 1T112			
IC175	78928	Capacitor—Fixed, ceramic, 1.5 mmf., ± 0.25 mmf., 500 volts			
IC176 to IC179 incl. }		Part of 1T113			
IC180		Same as IC128			
IC181-A, B	78930	Capacitor—Fixed, electrolytic, 35-500 mfd., -10 , $+100$, $+250\%$, 300-6 volts D.C.			
IC209	39660	Capacitor—Fixed, mica, 2200 mmf., $\pm 5\%$, 500 volts			
IC210		Same as IC171			
IC211	78923	Capacitor—Fixed, paper, 0.22 mf., $\pm 10\%$, 400 volts			

REPLACEMENT PARTS (Continued)

CT-100

SYMBOL NO.	STOCK NO.	DESCRIPTION	SYMBOL NO.	STOCK NO.	DESCRIPTION
1R171	5164	Resistor—Fixed, composition, 560 ohms, $\pm 5\%$, $\frac{1}{2}$ watt			
1R172		Part of 1T107	2C101, 2C102	73592	Capacitor—Fixed, paper, .047 mf., $\pm 20\%$, 600 volts
1R174		Part of 1T108	2C103, 2C104	78957	Capacitor—Fixed, electrolytic, 200 mf., -10 +100%, 250 V.D.C.
1R175		Same as 1R168	2C105, 2C106	18950	Capacitor—Fixed, electrolytic, 80 mfd., -10 +20%, 450 V.D.C.
1R177		Same as 1R170	2C107	72611	Capacitor—Fixed, electrolytic, 1000 mf., 3 volts
1R178	502322	Resistor—Fixed, composition, 22,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C133	78977	Capacitor—Fixed, paper, oil impregnated, 0.47 mf., $\pm 20\%$, 400 volts
1R180		Same as 1R168	2C135	73599	Capacitor—Fixed, paper, oil impregnated, .0027 mf., $\pm 10\%$, 600 volts
1R181	503468	Resistor—Fixed, composition, 680,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt	2C136	73595	Capacitor—Fixed, paper, oil impregnated, .0022 mf., $\pm 20\%$, 600 volts
1R182	503512	Resistor—Fixed, composition, 1.2 megohm, $\pm 10\%$, $\frac{1}{2}$ watt	2C137	73561	Capacitor—Fixed, paper, oil impregnated, .01 mf., $\pm 20\%$, 400 volts
1R183	503310	Resistor—Fixed, composition, 10,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt	2C138	78916	Capacitor—Fixed, ceramic, 270 mmf., $\pm 5\%$, 500 volts
1R184		Same as 1R170	2C139	76474	Capacitor—Fixed, mica, 82 mmf., $\pm 10\%$, 1000 volts
1R185		Same as 1R195	2C140	39644	Capacitor—Fixed, mica, 470 mmf., $\pm 5\%$, 500 volts
1R186	502115	Resistor—Fixed, composition, 150 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C182	73551	Capacitor—Fixed, paper, oil impregnated, 0.1 mf., $\pm 20\%$, 400 volts
1R187		Same as 1R164	2C183	39654	Capacitor—Fixed, mica, 1200 mmf., $\pm 5\%$, 300 volts
1R188	502227	Resistor—Fixed, composition, 2700 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C184	79191	Capacitor—Fixed, mica, 330 mmf., $\pm 5\%$, 500 volts
1R189		Same as 1R170	2C185	78944	Capacitor—Fixed, ceramic, disc 820 mmf., $\pm 20\%$, 500 volts
1R190	502112	Resistor—Fixed, composition, 120 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C186	78962	Trimmer—Hue control trimmer air dielectric 23-4 mmf.
1R194	78908	Resistor—Fixed, wire wound, 2200 ohms, $\pm 10\%$, 5 watts	2C187	78911	Capacitor—Fixed, ceramic, 3 mmf., ± 0.25 mmf., 500 volts
1R195	502422	Resistor—Fixed, composition, 220,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C188	70596	Capacitor—Fixed, ceramic, 33 mmf., $\pm 5\%$, 500 volts
1R196		Same as 1R167	2C189	78922	Capacitor—Fixed, paper, 0.1 mf., $\pm 10\%$, 400 volts
1R197	502222	Resistor—Fixed, composition, 2200 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C190	39652	Capacitor—Fixed, mica, 1000 mmf., $\pm 5\%$, 500 volts
1R199	502247	Resistor—Fixed, composition, 4700 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C191, A,B,C,D	78946	Capacitor—Fixed, electrolytic, 20-20-20 mf., 450 volts, 100 mf., 50 volts
1R238	78942	Control—Horizontal convergence amplifier control	2C192	73554	Capacitor—Fixed, paper, oil impregnated, .027 mf., $\pm 10\%$, 400 volts
1R248-A, B	78937	Control—Vertical convergence amp. and vertical convergence shape control	2C193		Same as 2C184
1R249		Same as 1R181	2C194		Same as 2C137
1R250	503527	Resistor—Fixed, composition, 2.7 megohm, $\pm 10\%$, $\frac{1}{2}$ watt	2C195		Same as 2C182
1R251		Same as 1R122	2C196		Same as 2C185
1R252	503510	Resistor—Fixed, composition, 1 megohm, $\pm 10\%$, $\frac{1}{2}$ watt	2C201		Same as 2C182
1R276		Same as 1R166	2C206	78923	Capacitor—Fixed, paper, 0.22 mf., $\pm 10\%$, 400 volts
1R277	523256	Resistor—Fixed, composition, 5600 ohms, $\pm 10\%$, 2 watts	2C207		Same as 2C137
1R278	35256	Resistor—Fixed, composition, 75,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C208	78905	Capacitor—Fixed, paper, oil impregnated, 0.22 mf., $\pm 20\%$, 200 volts
1R279	3219	Resistor—Fixed, composition, 18,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C217	78979	Capacitor—Fixed, paper, oil impregnated, .0082 mf., $\pm 10\%$, 600 volts
1R280		Same as 1R252	2C222		Same as 2C185
1R281	503147	Resistor—Fixed, composition, 470 ohms, $\pm 10\%$, $\frac{1}{2}$ watt	2C231		Same as 2C190
1R282-A, B	78936	Control—Vertical linearity and height control	2C232	73802	Capacitor—Fixed, paper, .0015 mf., $\pm 10\%$, 1000 volts
1R283-A, B	78934	Control—Vertical and horizontal hold control	2C234	73594	Capacitor—Fixed, paper, oil impregnated, .01 mf., $\pm 5\%$, 600 volts
1R284		Same as 1R252	2C235	33380	Capacitor—Fixed, ceramic, 12 mmf., $\pm 5\%$, 500 volts
1R285			2C236	76476	Capacitor—Fixed, mica, 330 mmf., $\pm 5\%$, 1000 volts
1R292	503382	Resistor—Fixed, composition, 82,000 ohms, $\pm 10\%$, 1 watt	2C237	74923	Trimmer—Horizontal locking range
1R294	513356	Resistor—Fixed, composition, 56,000 ohms, $\pm 10\%$, 1 watt	2C243	73553	Capacitor—Fixed, paper, oil impregnated, .047 mfd., $\pm 20\%$, 400 volts
1R300		Same as 1R110	2C244	73787	Capacitor—Fixed, paper, oil impregnated, 0.47 mf., $\pm 20\%$, 200 volts
1R301	503247	Resistor—Fixed, composition, 4700 ohms, $\pm 10\%$, $\frac{1}{2}$ watt	2C245		Same as 2C182
1R386	513339	Resistor—Fixed, composition, 39,000 ohms, $\pm 10\%$, 1 watt	2C246	71514	Capacitor—Fixed, ceramic, 82 mmf., $\pm 5\%$, 500 volts
1R387		Same as 1R116	2C247	39652	Capacitor—Fixed, ceramic, 150 mmf., $\pm 5\%$, 500 volts
1R388	502418	Resistor—Fixed, composition, 180,000 ohms, $\pm 5\%$, $\frac{1}{2}$ watt	2C248	39638	Capacitor—Fixed, mica, 270 mmf., $\pm 5\%$, 500 volts
1R389	503010	Resistor—Fixed, composition, 10 ohms, $\pm 10\%$, $\frac{1}{2}$ watt	2C249	73960	Capacitor—Fixed, paper, .01 mf., $\pm 10\%$, -0% , 500 volts
1S101		Part of 1R124	2C250	78921	Capacitor—Fixed, paper, .047 mf., $\pm 10\%$, 400 volts
1T102	78995	Transformer—1.F. sound take-off transformer (includes 1C109, 1L116, 1CR101)	2C251	79181	Capacitor—Fixed, electrolytic, 2 mf., ± 100 -10% , 50 volts
1T103	78996	Transformer—1.F. 1st, sound 4.5 M.C. (includes 1C112, 1C113)	2C252	39659	Capacitor—Fixed, mica, 2000 mmf., $\pm 5\%$, 500 volts
1T104	78997	Transformer—1.F. ratio-detector (includes 1C118)	2C253		Same as 2C249
1T106	78987	Transformer—1.F. link pix (L2) transformer 41.24 M.C. (includes 1C148, 1C149, 1C150)	2C254-A,B	78901	Capacitor—Fixed, mica, 2200-2200 mmf.
1T107	78988	Transformer—1.F. 1st pix (M1) transformer 40.7 M.C. (includes 1C155, 1C154, 1R172)	2C255		Part of 2T122
1T108	78989	Transformer—1.F. 1st pix (M2) transformer 47.25 M.C. (includes 1C156)	2C256		Same as 2C185
1T109	78990	Transformer—1.F. 2nd pix	2C257		Same as 2C137
1T110	78991	Transformer—1.F. 3rd pix	2C259		Same as 2C182
1T111	78992	Transformer—1.F. 4th. pix	2C260		Same as 2C137
1T112	78993	Transformer—1.F. 5th. pix (M1) 47.25 M.C. (includes 1C174)	2C261	78573	Capacitor—Fixed, electrolytic, 50 mf., $\pm 150\%$ -10% , 6 volts
1T113	78994	Transformer—1.F. 5th. pix (M2) (includes 1C176, 1C177, 1C178, 1C179, 1L115, 1CR102)	2C262	78913	Capacitor—Fixed, ceramic, 47 mmf., $\pm 5\%$, 500 volts
1T120	77823	Transformer—Vertical output transformer	2C263		Same as 2C249
1T121	74144	Transformer—Vertical oscillator	2C264		Same as 2C188
	76534	Shield—Tube shield for 76336	2C265	44704	Capacitor—Fixed, ceramic, 150 mmf., $\pm 5\%$, 500 volts
	73521	Shield—Tube shield for 7 pin min. tube			
	76972	Shield—Tube shield for 9 pin min. tube			
	73117	Socket—Tube, 7 pin min.			
	79180	Socket—Tube, 7 pin min. ceramic			
	76971	Socket—Tube, 9 pin min.			
	76336	Socket—Tube, 9 pin min.			
	76463	Terminal—Screw type grounding terminal			
	76460	Terminal—Test point terminal			
			2C266	33101	Capacitor—Fixed, ceramic, 22 mmf., $\pm 5\%$, 500 volts
			2C267		Same as 2C182

REPLACEMENT PARTS (Continued)

SYMBOL NO.	STOCK NO.	DESCRIPTION	SYMBOL NO.	STOCK NO.	DESCRIPTION
2C268	78920	Capacitor—Fixed, electrolytic, 2 mt., +100%, -10%, 350 volts	2R179	503122	Resistor—Fixed, composition, 220 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C273		Same as 2C182	2R191	79039	Resistor—Fixed, w.w., 33 ohms, $\pm 5\%$, 15 watts
2C275		Same as 2C137	2R193	28744	Resistor—Fixed, composition, 33,000 ohms, $\pm 5\%$, 2 watts
2C276		Same as 2C208	2R198	502218	Resistor—Fixed, composition, 1800 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
2C277		Same as 2C249	2R200	503310	Resistor—Fixed, composition, 10,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C278	99132	Capacitor—Fixed, ceramic, 2 mmf., ± 0.25 mmf., 500 volts	2R201	79182	Resistor—Fixed, wire wound, 10,000 ohms, $\pm 10\%$, 10 watts
		Same as 2C249	2R202	512112	Resistor—Fixed, composition, 120 ohms, $\pm 5\%$, 1 watt
2C279		Part of 2T124	2R203		Same as 2R200
2C280		Same as 2C249	2R204	78948	Control—Contrast control
2C281		Same as 2C278	2R205	79184	Resistor—Fixed, wire wound, 12,500 ohms, $\pm 10\%$, 10 watts
2C282		Part of 2T128	2R206		Same as 2R142
2C283		Same as 2C249	2R207	523233	Resistor—Fixed, composition, 3300 ohms, $\pm 10\%$, 2 watts
2C284		Same as 2C278	2R208	502227	Resistor—Fixed, composition, 2700 ohms, $\pm 5\%$, 1 watt
2C285		Part of 2T128	2R209	502222	Resistor—Fixed, composition, 2200 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
2C286		Same as 2C249	2R210	78956	Control—Contrast control
2C287			2R211		Same as 2R140
2C288			2R212	503122	Resistor—Fixed, composition, 220 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C289			2R213	503110	Resistor—Fixed, composition, 100 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C290			2R114	513347	Resistor—Fixed, composition, 47,000 ohms, $\pm 10\%$, 1 watt
2C291			2R115	523322	Resistor—Fixed, composition, 22,000 ohms, $\pm 10\%$, 2 watts
2C292			2R216		Same as 2R148
2C293	78912	Capacitor—Fixed, ceramic, 4 mmf., ± 0.25 mmf., 500 volts	2R217	503356	Resistor—Fixed, composition, 56,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C295	39396	Capacitor—Fixed, ceramic, 100 mmf., $\pm 5\%$, 500 volts	2R218		Same as 2R148
2C296	39041	Capacitor—Fixed, ceramic, 18 mmf., $\pm 5\%$, 500 volts	2R219	503427	Resistor—Fixed, composition, 270,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C297		Same as 2C182	2R220	503482	Resistor—Fixed, composition, 820,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C298	78914	Capacitor—Fixed, ceramic, 9 mmf., ± 0.25 mmf., 500 volts	2R221		Same as 2R136
2C299		Same as 2C268	2E222	503456	Resistor—Fixed, composition, 560,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C 05		Same as 2C182	2R223		Same as 2R140
2C307-A,B	78930	Capacitor—Fixed, dry electrolytic, 35-500 mf., -10%, +100%, -10%, +250%, 300 V.D.C., 6 V.D.C.	2R237	503510	Resistor—Fixed, composition, 1 megohm, $\pm 10\%$, $\frac{1}{2}$ watt
2C310		Same as 2C137	2R241	503422	Resistor—Fixed, composition, 220,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2C311	45465	Capacitor—Fixed, ceramic, 15 mmf., $\pm 5\%$, 500 volts	2R242		Same as 2R219
2C312	78915	Capacitor—Fixed, ceramic, 24 mmf., $\pm 5\%$, 500 volts	2R243	503518	Resistor—Fixed, composition, 1.8 megohm, $\pm 10\%$, $\frac{1}{2}$ watt
2C313	78917	Capacitor—Fixed, electrolytic, 15 mf., -10 +50%, 450 volts	2R244	503247	Resistor—Fixed, composition, 4700 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2F102	79358	Fuse—Heater fuse assembly, #26AWG wire with glass sleeve	2R245	503227	Resistor—Fixed, composition, 2700 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2F103		Fuse—0.25 Amps., 250 volts	2R246		Same as 2R243
2F104	73600	Fuse—4.5 Amps., 250 volts	2R247	78950	Control—Horizontal drive control
2F105	79357	Choke—Filter choke	2R266	503368	Resistor—Fixed, composition, 68,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2L101	78961	Coil—4.5 M.C. trap	2R273	503415	Resistor—Fixed, composition, 150,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2L108	78897	Coil—Peaking (250 millihenries)	2R274	502282	Resistor—Fixed, composition, 8200 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
2L109	71526	Coil—Peaking (36 millihenries)	2R275	512410	Resistor—Fixed, composition, 100,000 ohms, $\pm 5\%$, 1 watt
2L111	71793	Same as 2L109	2R287	512415	Resistor—Fixed, composition, 150,000 ohms, $\pm 5\%$, 1 watt
2L112		Coil—Band pass—secondary	2R288	513382	Resistor—Fixed, composition, 82,000 ohms, $\pm 10\%$, 1 watt
2L121	78888	Coil—Peaking (6.7 mh)	2R289		Same as 2R237
2L122	78902	Coil—Peaking (1.9 mh)	2R290	502239	Resistor—Fixed, composition, 3900 ohms, $\pm 5\%$, $\frac{1}{2}$ watt
2L123	78903	Coil—Peaking (20 microhenries)	2R291	513468	Resistor—Fixed, composition, 680,000 ohms, $\pm 10\%$, 1 watt
2L130	72618	Coil—Peaking (20 microhenries)	2R295	503322	Resistor—Fixed, composition, 22,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2L133			2R296	503215	Resistor—Fixed, composition, 1500 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2L134	79185	Coil—Peaking (1 mh)	2R297		Same as 2R209
2L137	79119	Coil—Field neutralizing coil	2R298	522339	Resistor—Fixed, composition, 39,000 ohms, $\pm 5\%$, 2 watts
2L140			2R299	503410	Resistor—Fixed, composition, 100,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2L141	78892	Coil—Burst input, 3.58 M.C. trap	2R302	512218	Resistor—Fixed, composition, 1800 ohms, $\pm 5\%$, 1 watt
2L143			2R303		Same as 2R134
2L144	79126	Coil—Purifying coil	2R304	503315	Resistor—Fixed, composition, 15,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2P101B	68590	Socket—Tube, octal	2R305	502510	Resistor—Fixed, composition, 1 megohm, $\pm 5\%$, $\frac{1}{2}$ watt
2P102A	78904	Connector—Female, 3 contact	2R306	78952	Control—A.F.C. balance control
2P103A	33165	Connector—Female, 2 contact	2R307		Same as 2R305
2P103B	33166	Plug—Purifying coil plug male—2 contact	2R308	503556	Resistor—Fixed, composition, 5.6 megohm, $\pm 10\%$, $\frac{1}{2}$ watt
2R103	503356	Resistor—Fixed, composition, 56,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt	2R309	514710	Resistor—Fixed, composition, 100 megohm, $\pm 10\%$, 1 watt
2R104-A,B	78953	Control—Vertical centering control	2R310		Same as 2R142
2R105	523347	Resistor—Fixed, composition, 47,000 ohms, $\pm 10\%$, 2 watts	2R311	503115	Resistor—Fixed, composition, 150 ohms, $\pm 10\%$, $\frac{1}{2}$ watt
2R106	78955	Control—Purifying control			
2R107	78954	Control—Field neutralization control			
2R128		Same as 2R148			
2R134	503222	Resistor—Fixed, composition, 2200 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R135	523368	Resistor—Fixed, composition, 68,000 ohms, $\pm 10\%$, 2 watts			
2R136	503347	Resistor—Fixed, composition, 47,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R140	503552	Resistor—Fixed, composition, 2.2 megohm, $\pm 10\%$, $\frac{1}{2}$ watt			
2R141	503547	Resistor—Fixed, composition, 4.7 megohm, $\pm 10\%$, $\frac{1}{2}$ watt			
2R142	503327	Resistor—Fixed, composition, 27,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R143	503239	Resistor—Fixed, composition, 3900 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R145		Same as 2R136			
2R146	503282	Resistor—Fixed, composition, 8200 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R147	523333	Resistor—Fixed, composition, 33,000 ohms, $\pm 10\%$, 2 watts			
2R148	503322	Resistor—Fixed, composition, 22,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R149	503333	Resistor—Fixed, composition, 33,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R160	503318	Resistor—Fixed, composition, 18,000 ohms, $\pm 10\%$, $\frac{1}{2}$ watt			
2R176		Same as 2R141			

REPLACEMENT PARTS (Continued)

CT-100

SYMBOL NO.	STOCK NO.	DESCRIPTION	SYMBOL NO.	STOCK NO.	DESCRIPTION
2R312		Same as 2R200	3C204	79024	Capacitor—Fixed, ceramic, 1200 mmf., —20%, +50%, 15,000 volts DC
2R313		Same as 2R217	3C205	79027	Capacitor—Fixed, ceramic, 500 mmf., ±20%, 10,000 volts DC
2R314		Same as 2R245	3C213	73794	Capacitor—Fixed, paper, oil impregnated, 0.22 mf., ±20%, 400 volts
2R315	513339	Resistor—Fixed, composition, 39,000 ohms, ±10%, 1 watt	3C214	73787	Capacitor—Fixed, paper, oil impregnated, .47 mf., ±10%, 200 volts
2R316	513310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 1 watt	3C215	79008	Capacitor—Fixed, ceramic, 500 mmf., +50%, —0%, 30,000 V.D.C.
2R317	78951	Control—Color control	3C216	73553	Capacitor—Fixed, paper, oil impregnated, .047 mf., ±10%, 400 volts
2R318	503056	Resistor—Fixed, composition, 56 ohms, ±10%, 1/2 watt	3C218		Same as 3C204
2R319	503110	Resistor—Fixed, composition, 100 ohms, ±10%, 1/2 watt	3C219	78918	Capacitor—Fixed, paper, .01 mf., ±20%, 6000 volts
2R320		Same as 2R205	3C221	78927	Capacitor—Fixed, electrolytic, 20 mf., ±250%, —10%, 50 volts
2R321	512318	Resistor—Fixed, composition, 18,000 ohms, ±5%, 1 watt	3C223	74957	Capacitor—Fixed, paper, oil impregnated, 0.2 mf., ±20%, 600 volts
2R322	503568	Resistor—Fixed, composition, 6.8 megohm, ±10%, 1/2 watt	3C224	78924	Capacitor—Fixed, electrolytic, 25 mf., +250%, —10%, 10 volts
2R323	503439	Resistor—Fixed, composition, 390,000 ohms, ±10%, 1/2 watt	3C225		Same as 3C213
2R324	38895	Resistor—Fixed, composition, 33,000 ohms, ±5%, 1 watt	3C226	73798	Capacitor—Fixed, paper, oil impregnated, .022 mf., ±20%, 600 volts
2R325	19794	Resistor—Fixed, composition, 3000 ohms, ±5%, 1/2 watt	3C227	79041	Capacitor—Fixed, paper, oil impregnated, 0.18 mf., ±10%, 400 volts
2R338		Same as 2R237	3C228		Same as 3C214
2R340		Same as 2R304	3C229	79040	Capacitor—Fixed, electrolytic, 40 mf., +100%, —10%, 200 volts
2R341	502210	Resistor—Fixed, composition, 1000 ohms, ±5%, 1/2 watt	3C274		Part of Yoke
2R342	513312	Resistor—Fixed, composition, 12,000 ohms, ±10%, 1 watt	3C314	91392	Capacitor—Fixed, electrolytic, 50 mf., +200%, —10%, 50 volts
2R343	502133	Resistor—Fixed, composition, 330 ohms, ±5%, 1/2 watt	3F101	78798	Fuse—.45 amps, 250 volts
2R344	523327	Resistor—Fixed, composition, 27,000 ohms, ±10%, 2 watts	3L120	79010	Coil—Width control coil
2R345		Same as 2R134	3L126		Part of Yoke
2R346	503415	Resistor—Fixed, composition, 150,000 ohms, ±10%, 1/2 watt	to 3L129		
2R347	523339	Resistor—Fixed, composition, 39,000 ohms, ±10%, 2 watts	Incl.		
2R348	503118	Resistor—Fixed, composition, 180 ohms, ±10%, 1/2 watt	3L139	79009	Coil—Horizontal convergence output coil
2R349		Same as 2R214	3L145	76441	Coil—Horizontal linearity coil
2R350	523310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 2 watts	3R239	503482	Resistor—Fixed, composition, 820,000 ohms, ±10%, 1/2 watt
2R351, 2R352, 2R353, 2R354, 2R355, 2R356, 2R357	502247	Part of 2T125	3R240	503056	Resistor—Fixed, composition, 56 ohms, ±10%, 1/2 watt
2R358		Same as 2R237	3R253	78926	Resistor—Fixed, composition, 50 megohm, ±5%, 3 watts
2R359		Same as 2R319	3R254	79029	Control—DC convergence control
2R361		Same as 2R317	3R255	78925	Resistor—Fixed, composition, 50 megohm, ±5%, 3 watts
2R362		Same as 2R214	3R256	79030	Control—High voltage adjustment control
2R363	512247	Resistor—Fixed, composition, 4700 ohms, ±5%, 1 watt	3R257	513518	Resistor—Fixed, composition, 1.8 megohm, ±10%, 1 watt
2R364		Same as 2R323	3R258	503510	Resistor—Fixed, composition, 1 megohm, ±10%, 1/2 watt
2R365	503533	Resistor—Fixed, composition, 3.3 megohm, ±10%, 1/2 watt	3R259	79028	Control—Focus adjusting control
2R366	522310	Resistor—Fixed, composition, 10,000 ohms, ±5%, 2 watts	3R260	522582	Resistor—Fixed, composition, 8.2 megohm, ±10%, 2 watts
2R367	35255	Resistor—Fixed, composition, 6200 ohms, ±5%, 1/2 watt	3R261	79031	Control—Horizontal centering control
2R379		Same as 2R237	3R262	513247	Resistor—Fixed, composition, 4700 ohms, ±10%, 1 watt
2R384		Same as 2R200	3R263	513012	Resistor—Fixed, Composition, 12 ohms, ±10%, 1 watt
2R385	513310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 1 watt	3R264	503112	Resistor—Fixed, composition, 120 ohms, ±10%, 1/2 watt
2SR101, 2SR102, 2T101, 2T119, 2T122, 2T123, 2T124	78894, 78893, 75213, 78886, 78890, 78891	Rectifier—Selenium rectifier Transformer—Power transformer Transformer—Horizontal oscillator transformer Transformer—Burst amplifier transformer Coil—"I" time delay filter coil Coil—Reactance tube plate coil (includes 2C280, 2C281, 2C282)	3R268	503368	Resistor—Fixed, composition, 68,000 ohms, ±10%, 1/2 watt
2T215	78895	Transformer—Quadrature transformer (includes 2C290, 2C291, 2R351, 2R352)	3R269	523222	Resistor—Fixed, composition, 2200 ohms, ±10%, 2 watts
2T126	78887	Transformer—Band pass primary transformer	3R286	503310	Resistor—Fixed, composition, 10,000 ohms, ±10%, 1/2 watt
2T128	78889	Coil—Oscillator output coil adjustable, 3.6-9.5 microhenries	3R381, 3R382, 3R383, 3T117, 3T127	79012, 79006	Part of Yoke Part of 3T117 Transformer—High voltage transformer Transformer—Vertical dynamic converging and focusing transformer
2T129	78900	Coil—Vertical centering coil	79000		Bushing—Metal bushing for tube socket mounting
2TD101	79177	Delay Line	79005		Clamp—Anode lead clamp
2Y101	78896, 78958, 72175, 18469	Crystal—Plug in type 3, 579.545 KC Coupling—Contrast resistor coupling Cover—Electrolytic insulation cover Plate—Electrolytic mounting plate for 2C103, 2C104	48894, 61139, 79179, 79004, 79036, 79037, 79167, 79032		Holder—Fuse holder Holder—Tube holder Lead—Anode lead assembly female Plate—Insulation plate, glass silicone Retainer—Socket retainer Ring—Corona ring Screw—Self tapping screw #8 hex head Shell—Corona and high voltage capacitor mounting shell (small)
3C134	77673	Capacitor—Fixed, ceramic, 470 mmf., ±10%, 1500 volts	77661		Shell—High voltage capacitor mounting shell (large)
3C202	79025	Capacitor—Fixed, ceramic, 47 mmf., ±10%, 10,000 volts DC	72627, 68590, 79038, 79034, 79033		Socket—Tube, 8 pin miniature, statite Socket—Tube, 8 pin miniature, black phenolic Socket—Tube, octal, 4 contact, phenolic Socket—Tube, 9 pin miniature, mica Washer—Cup washer for high voltage capacitor mounting
3C203	79026	Capacitor—Fixed, ceramic, 150 mmf., ±20%, 10,000 V.D.C.	4C197	78919	VIDEO BOARD ASSEMBLY—GREEN Capacitor—Fixed, electrolytic, 4 mf., +100%, —10%, 350 volts
		HIGH VOLTAGE UNIT ASSEMBLIES	4C198, 4C199, 4C200	78922	Capacitor—Fixed, paper, 0.1 mf., ±10%, 400 volts
			4C302	78921	Capacitor—Fixed, paper, .047 mf., ±10%, 400 volts
			4L113, 4L114	76992	Capacitor—Fixed, mica, 470 mmf., ±5%, 300 volts
				98482, 75253	Coil—Peaking (250 M.H.) Coil—Peaking (120 M.H.)

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